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Industrial Re-Equipment

Dr. JULIUS KLEIN
Assistant Secretary of Commerce

Revival of industry, creation of jobs, return of prosperity—here is a sequence that every one of us would welcome and should work for. The way to start it is through purchase of equipment that will cut costs to replace old units of equivalent capacity

AS WE gradually mount the slope of business recovery—continuing to emerge from the gloomy valley into the brighter regions of better times—we are confronted with one great question that overshadows every other. That is the question of *jobs*. The tragic plight of the unemployed must be alleviated. More jobs must be created for the men and women who are now so desperately in need of work and so intensely eager to find it. From both the human and the business standpoint, this is the most urgent factor in the stimulation of the upward movement. Purchasing power must be restored—and it can only be restored through more jobs.

In what ways can thousands of new jobs be created? How can stricken or sluggish industries be revived? Those were the weighty problems which were before the great conference of business leaders of all industries that met here in Washington at the invitation of the President last August. Since then a number of campaigns focused specifically upon those very objectives have been moving actively, along varied and vital lines, to strengthen the gathering forces of business recovery. One of those lines is the endeavor to induce factory-owners and other industrialists to re-equip their plants with new machinery and tools. Now if you do not happen to work in a machine factory yourself, you wonder why I venture to bother you with such a story. But I think I can prove to you that this can become one of the major sectors of our battle front in the fight for recovery. The presence of obsolete machinery is plainly a serious impediment to profitable business; its replacement will provide a really tremendous stimulus, not only to the machinery producers but to the users as a valuable economy, in cutting costs when low prices are a commanding influence.

Let me give one example of such dollars-and-cents benefits. A company in the eastern part of the country has been postponing from year to year the installation of new heating boilers. They fondly cherished the belief that they were saving money by so doing. But finally they bought new boilers. The following autumn they put in the usual supply of coal for the winter. Next spring the head of the company happened to pass by the coal pile. He had assumed, of course, that it would be just about used up. To his amazement he observed that it was still a pile of very healthy proportions. "How come?" he asked himself—and then he asked the engineer. The latter was a bit vague but answered: "Oh, we seem to have had a pretty mild winter—haven't needed the usual amount of coal." But the boss was still puzzled and not satisfied. He checked with the local Weather Bureau; found that the winter had been just as severe as any recent one. "It must be the boilers," he finally concluded. Investigation showed that it *was*. The new boilers had used only half as much coal as the old ones, which had been disgracefully wasteful and inefficient. The gist of the matter was that this company had actually been paying for the new boilers once every two years, in extra, needless coal bills—but had nothing whatever to show for it until they mustered up the courage and common sense to sign the order for the new equipment. There could hardly be a better illustration of the costly folly (to say nothing of the downright danger) of permitting productive equipment to become obsolete. The same principle certainly applies to many thousands of other cases.

Reluctance to recognize that principle has wrought serious damage to our business structure in the past few years, during which all classes of American business have passed through some trying and tragic experiences. But no single great group has been so hard hit as the manufacturers of what we call "capital goods." By that we mean, of course, industrial equipment, machinery, tools, and plant facilities—goods designed to be used in producing *other* merchandise or service.

What has been the relative position of these particular manufacturing interests during the depression? Let us compare them with the makers of "consumers' goods"—articles such as clothing, food, motor cars, and so on, actually used for the personal needs and enjoyment of the purchaser—the ultimate consumer. Between 1929 and 1932, the producers of such consumers' goods and services suffered a drop of

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A radio talk by Dr. Julius Klein, Assistant Secretary of Commerce, delivered over the coast-to-coast network of the Columbia Broadcasting System, from Washington, November 6, 1932.

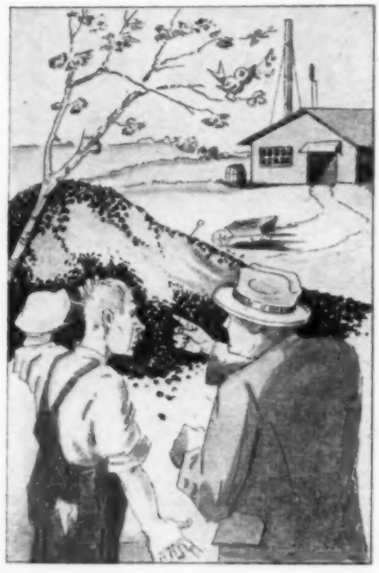
37½ per cent in their annual payrolls. Deplorable, to be sure! But, as against this, the producers of capital goods—machinery, equipment, and the like—have been compelled to cut *72 per cent* from their payrolls. In the actual number of workers employed, the capital-goods people have been the victims of a 62 per cent falling-off, as compared with only 25 per cent for the makers of consumer goods. The "spread" between the two groups is startling. We find that the machinery and related industries have suffered twice as bad a blow as those industries whose sales appeal is directly to consumers like you and me.

It is not difficult to understand why this has been so. Factory machinery is vastly more expensive than the articles used by the average individual. Naturally one hesitates a good deal longer before spending the relatively big sum involved. That is a large-scale venture—and greater elements of *uncertainty* enter into it. The ultimate consumer knows quite well that he can utilize to good advantage the merchandise he buys (depression or no depression!)—but the user of "capital goods" is situated differently. His use for new factory equipment is in turning out new goods which he has to sell. If he has really serious doubts about his ability to sell these, and if the purchase of new machinery seems, therefore, somewhat risky, he is of course more likely to yield to hesitancy or apprehension, and to refrain, during hard times, from buying the new devices.

There are other deterrent influences. Often, the managers of an industry do not realize the true extent of the waste that is involved in machinery which is out of date or is becoming so (as in the case of the boilers and the coal pile). Or if they *do* give the matter some thoughtful consideration, they may fear the evil of excess capacity: they may be afraid that the super-efficient new devices will give them a productive power greater than their available markets can absorb. Or—feeling a genuine concern for the welfare of their employees—they may fear that modern machinery would throw more men out of work.

55 Per Cent Obsolete

I shall have something to say in response to every one of these points. I am convinced that many manufacturers are acting unwisely in refraining from the purchase of new equipment, if they are able to muster up the necessary money. Experts who have studied the situation tell me that no less than *55 per cent* of the present equipment of American industry is now more than ten years old and much of it is consequently inefficient. That is an astonishing statement. The percentage seems shockingly high. It means that our factories are now "down at the heel" to an alarming extent. Altogether too many of them are dilapidated, lagging behind the march of progress. Such neglect is depressing, injurious, costly in many ways. Out-of-date machinery in a factory increases the expense of operation, and cuts down (or prevents) the profits that are so urgently needed. One can hardly repeat too often the fact that very frequently the loss on old equipment amounts to more than the cost of replacement with thoroughly modern machinery.



Unburned coal testifies to the efficiency of new equipment

Here is one significant thing: During these past three years of depression there has been a rapid improvement in factory-equipment design. There has been no halt in science. The inquiring, pioneering spirit has persisted, as is vividly demonstrated in the mounting demands on the Patent Office. Inventors and engineers have not been idle, in the least; on the contrary, with greater leisure and a definite relaxation of immediate, engrossing tasks, they have been making research a reality instead of a cloistered academic aspiration. Thus many new ideas and devices have come into being. These are ingenious, practical, typically American in their swift conquest of new mechanical fields.

Now, in view of these strides, what is going to be the position of the manufacturer who clings stubbornly to antiquated equipment? Where is he going to find himself after the tide of business recovery has carried us back to good times? To put it colloquially, he's going to be "out of luck." He's likely to find himself frustrated and defeated, like a warrior whose sword has become corroded with rust—or cast into outer darkness, like the foolish maidens in the Bible story who failed to keep their lamps replenished with oil, till the great moment came.

Such unwise manufacturers will find their competitive ability disastrously impaired—at the very time when competition will be fiercest and most acute. Hampered and shackled themselves by the inadequacy of their equipment, they will be compelled, with keen chagrin, to watch their rivals racing ahead and occupying the choicest vantage-points of business, through the aid afforded by modern cost-reducing machinery. Such a prospect is not pleasant. Fortunately, in many cases it can be avoided.

A Boost For Business

If a manufacturer knows that he needs new equipment for his factory, his first query naturally is as to his ability to command the necessary funds. But as I hope to point out in a moment, he may find this less difficult now than was the case a few years ago. If he then proves his own shrewdness and good sense by ordering modernized equipment he will be contributing to a great Nation-wide movement which can do as much as any other single factor to give business an energetic and enduring upward push.

This is an enormously helpful *job-producing movement*. If it is carried out as it *should* be, it will mean a large increase in many trades throughout the country—a stimulation to many industries, through its influence on the successive stages of industrial purchasing. And this would mean an increased volume of general business, through the spending of the new wages for food, clothing, and other merchandise.

I am not exaggerating the potential benefits of this industrial rehabilitation. It would be hard, in fact, to overstate them. Students of the situation have definitely ascertained that, since the beginning of the depression, our industrialists have refrained from purchasing about *five billion dollars' worth* of industrial equipment which they would normally have bought during the past three years if times had continued good. That's a pretty sizeable sum—five billion dollars. If any considerable part of that amount of business were now to be set vigorously in motion (as the President and the Business Committees hope may be done), the beneficial effect would certainly be immense. The kind of equipment that needs modernization ranges from machine tools to excavating machinery, from engines and turbines to mechanical equipment for offices, from pumping equipment to steam locomotives.

Every order for improved equipment in these or any one of many other classes starts a chain of other orders, a wave of work required in the production, processing, transportation, installation, and sale of material and services, reaching straight back to our mines, our forests, and our farms. Also (and this is highly important) the new machinery itself cuts production costs. That increases competitive ability and enhances the product's appeal to the consumer. That means wider markets—creating, in turn, additional employment for clerks, salespeople, transportation workers, and others engaged in distribution, servicing, and similar activities.

Possibly a good many manufacturers will say: But what am I to "use for money" in purchasing new productive equipment for my factory? So far as corporations are concerned, it is certain that many of them have liquid funds drawing low interest that might much better be invested in more profitable equipment. Many companies and corporations have much more money available today than is commonly realized. To finance equipment-modernization they can employ surplus money now in banks or in bonds. Or, if funds are not available, industrialists can take advantage of the easier credit conditions now prevailing and borrow from a bank on short-term loan to be refunded by sale of stock when conditions improve and the market is favorable—or they can raise new money for capital investment by the sale of preferred stock—or they can borrow from a commercial credit company on the long-time-installment payment basis, if the prospective savings justify this incheased cost of financing. Right in this connection I want to emphasize the fact that equipment can be purchased and installed to-day at a cost far below normal, and changes in equipment can be made now most easily when plants are not so busy.

Excess Capacity

Just a word about something that I mentioned a monent ago: the fear of "excess capacity" if new machinery is installed. That fear will hardly stand up under even a moment's examination. Nobody is urging the manufacturer to fill up his plant with new machinery that he does not need, and the capacity of which will exceed the markets that are in sight. Not at all! It's simply a question of calculating the capacity of the improved equipment whose purchase is contemplated, and then buying and installing only enough new machines to provide for the same production as the old machines that are being displaced and scrapped. There will be no excess capacity *then*.

Now as to the hackneyed but serious charge that the introduction of new machinery is undesirable because it "throws men out of work"—by which phrase is generally meant the assertion that better machinery decreases the total employment in the country. In a number of these talks in the past, I have shown that this common belief really is not warranted. The statistics do not support it. Between 1880 and 1927—the period when industrial machinery was advancing with giant strides in this country—the proportion of our population *gainfully employed* did not show any decrease; on the contrary, it actually rose from 34.7 per cent to 37.6 per cent. Considering the matter in its broadest aspect, we see plainly, therefore, that new machinery did not lessen the chances of the average person's getting a job; it *increased*, to an appreciable degree, the likelihood of his finding work.

New Jobs

How did that come about, you ask? In a very simple way. New mechanization has created new occupations through the development of new industries—the automobile, the radio, office equipment, new heating apparatus, motion pictures, and many other lines—and work has been provided for millions of people in making, distributing, and servicing the new devices which arose upon the basis of invention and new mechanical equipment. I will admit, readily enough, that mechanization and increased productivity per worker have caused some reduction in the number of workers employed in manufacturing. Migration from the farm has thrown a much larger number into the labor market. But in normal, "non-depression" times, both groups have found new occupations in such "non-factory" lines as construction, mercantile and clerical pursuits, and in the varied ramifications of the new industries such as I just mentioned, with their distributing systems and their essential facilities for service.

Consider the automobile industry, Modern improved machinery made possible this vast development. Because of the low prices resulting from this mechanical efficiency, motor vehicles have been distributed upon an enormous scale. And merely in servicing and operating them considerably more than a million and a half new jobs have been created—jobs as chauffeurs, in filling stations, in garages and repair shops—to say nothing of over a million more in other phases of the industry. As regards the effect of new machinery on wages and hours of work, in ordinary times, I can do no better than cite the fact that between the years 1913 and 1929 (the greatest "machine age") real wages—that is the actual buying-power wage, *not* the money payment—rose 36 per cent in this country, or as much as in the 43 years previous, while the hours of work steadily decreased. Both factors were very greatly to the advantage of the body of our laboring people, considered as a whole.

No, it would be utterly futile to attempt to turn back the hands of the clock of mechanical progress. We are all of us irrevocably linked up with the advance of the machine, the machine which has proved to be a salutary and beneficent agent, and we must proceed to use its benefits, sanely and circumspectly. If social and economic readjustments are necessary in order to enable us to do this, such readjustments can be effected.

Right at this moment, there can be no doubt that the purchase of new machinery is a project that will immediately spur business and create jobs. I again urge every manufacturer and industrialist to cooperate to the fullest extent of his ability—buying now the new equipment for which he sees the need. The Committee on Industrial Rehabilitation, of which Mr. A. W. Robertson is chairman, is building at the present moment an organization which will carry its plan throughout all industry. On the basis of Federal Reserve Districts, committees and sub-committees are being organized. Local leaders are accepting membership, with real eagerness and enthusiasm. Important executives are enrolling in the program to set in motion the orders for equipment, machinery and plant facilities throughout industry.

For the Future

All this is in accord with the true American spirit. As a people, we welcome with ardent alertness all mechanical innovations. Intelligent curiosity vitalizes our productive effort. We are impelled by a fervent striving, a quenchless passion for betterment. In the devices to be employed by American hands and brains, we are never content with anything short of the very best that seems attainable. The complacent conception of the "good enough" finds scant acceptance here. We discard, demolish, and scrap—in order to build more rewardingly and to equip our industries for greater profits. All this should be especially true of the keen, farsighted industrialist who knows the inescapable necessity of being *ready for the future*.

Let us hope that this splendid movement for industrial re-equipment will be attended with the fullest success! It means, in its every aspect, better business and *more jobs*.

Fluid Die Practice

HARRY SHAW
Consulting Engineer, Heywood, England

Bulging metal hydraulically permits the forming of many unusual shapes

FOR CERTAIN sheet metal objects, the conventional method of production with male and female press tools is so inconvenient that some other process becomes necessary.

One well-known method is spinning and another is rolling, both of which can be automatic or semi-automatic if quantities permit. While spinning, as commonly known, is applicable only to shapes that are solids of rotation, rolling can be applied to shapes which are not solids of rotation provided, however, that no sharp corners exist. This operation is done by pressing the rollers against the work with springs or air pressure and controlling them with a guide or cam so that they will produce the required shape.

Normally, however, both the spinning and the rolling processes are only adopted where the shapes are solids of rotation and quantities are small.

Where quantities are medium or large, both symmetrical and unsymmetrical shapes can be produced by bulging, a process which commonly employs a female die inverse to the shape of the piece to be produced and into which the blank is forced by some medium under pressure. The medium may be either oil or water; a granular material, such as sand, steel or lead shot; a ductile material such as lead; or a pliable material, such as rubber.

The hydraulic method, employing oil or water, is the only one dealt with here, as it is the one most convenient of application. The greater part of this article is devoted to methods believed to be novel. In general, the advantages of the hydraulic method over the ordinary press-tool method are:

1. Shapes can be produced that are impossible by the press-tool method.
2. The cost of tools or dies is less.
3. Dies and tools last longer.
4. The work is not scored by the tools unless the hydraulic pressure is too great for the work, when the metal will perhaps take the finish of the dies.
5. In forming certain shapes with ordinary press tools, only part of the metal is stretched to allow for the increase in area of the metal so that certain parts of the metal will be thinner than other parts. With the hydraulic method of production, the greater part of the metal is stretched to allow for the increase of area, and as this stretching is fairly uniform, the metal thickness throughout the produced piece is practically constant. Therefore, it is of greater strength than pieces produced in ordinary press tools.
6. With ordinary press tools the amount of stretching at a given point may be too great, causing rupture of the metal. Such parts have been produced by the hydraulic method because the stretching takes place over the whole of the metal and consequently is not excessive.
7. Material of a lower tensile strength can be used with the hydraulic method because of the reasons given above.

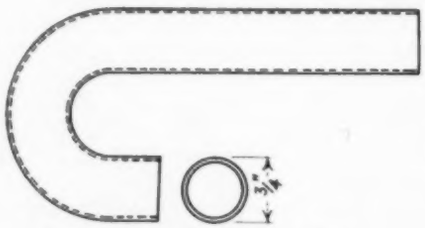


Fig. 1—This drawn shell is a simple example of hydraulic bending

The hydraulic method is usually applied in one of two ways. One method involves filling the object to be bulged with liquid and applying the pressure for bulging with a power press. In the second method, the liquid is forced under pressure from a hydraulic accumulator, or preferably from a hydraulic force pump, with which the pressure may be varied.

The advantages of the hydraulic method, employing an accumulator or force pump, over that employing a press for supplying the pressure are:

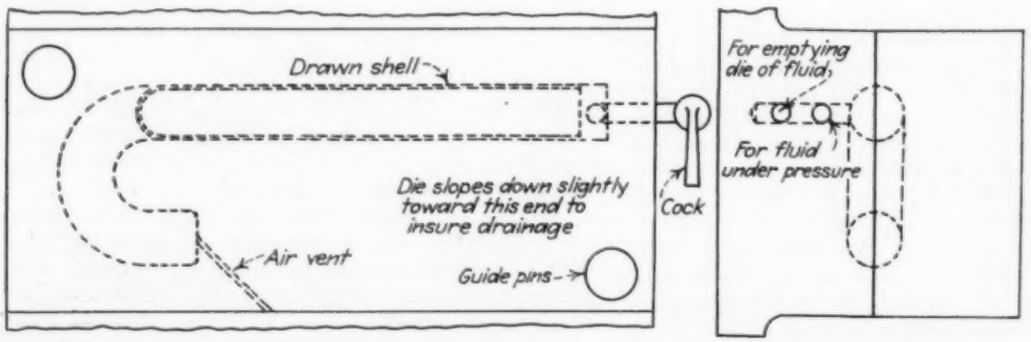


Fig. 2—For forming the part shown in Fig. 1, this die set-up is used

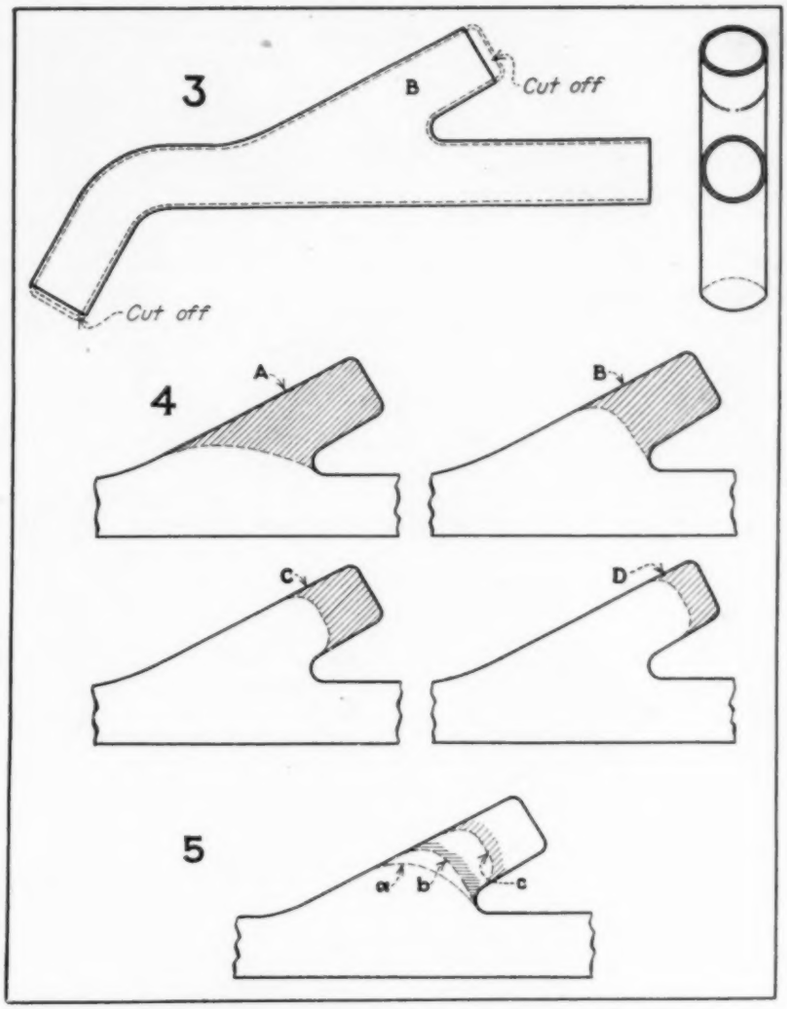


Fig. 3—With a little care, this piece may be produced hydraulically. Fig. 4—Lead plugs are employed to limit the amount of draw in one operation. Fig. 5—Inadequate annealing or variations in the stock may cause trouble

1. The bulging pressure can be more easily adjusted.

2. The fluid does not need to be measured to fill the part properly; hence the same care is not necessary, and the method is practically foolproof.

3. The bulging is done more gradually, allowing the metal a longer time to stretch and reducing the shock on the equipment.

4. A larger bulge can be produced at one operation. Where the press method is used, the size of bulge producible at one stroke is limited by the amount of fluid the original shell will hold. If a large bulge is to be produced it is necessary to increase the amount of fluid in the partly bulged shell and then complete the bulging in a second or perhaps a greater number of strokes.

5. There are no plungers to wear.

The piece shown in Fig. 1 is an example of the work that can be done by hydraulic bending. The drawn shell, from which the part is to be made, is placed in the die halves, Fig. 2, which are then held together by a ram, actuated either hydraulically or mechanically. The top half of the die is attached to the ram and is lifted out of the way when the ram ascends.

When fluid under pressure is admitted to the die, the shell is forced down into the die and around the bend. The bend produced in this way is of the desired shape and size, and the end is squared.

Air vents are provided in the die to allow the air to escape, otherwise the hydraulic pressure would be balanced by the air trapped behind the part. These vents should be shallow grooves formed in one of the faces of the die. If large vents are used the metal will be forced into them, leaving a mark which would have to be removed.

This bending die, and most simple dies, can usually be arranged for a cock with one movement to admit fluid to the clamping ram; a second movement to admit fluid to the die for forming the piece; a third movement to open both the die and hydraulic clamping ram to waste or return; and a final movement to admit fluid to the hydraulic clamping ram so as to raise the top half of the die.

The part shown in Fig. 3 is one that is practically impossible to produce by a press process, but is readily producible by the hydraulic bulging process. Starting with a drawn shell, the first operation is that of bending the end by hydraulically forcing the shell round a bend in a manner similar to that employed for bending the piece in Fig. 1.

If an attempt is made to produce the bulge *B*, Fig. 3, at one operation by forcing the metal hydraulically into a die of the proper shape, in all probability the metal would be ruptured or at least so weakened that the finished piece would be of little use. It is obvious that the bulging must be done in several steps with annealings between.

The various operations could be done in a series of dies, each varying slightly from the previous one, so that the part would be bulged slightly, when pressed hydraulically to fill each die in turn. As four or five sets of dies are an expensive proposition when quantities are not great, the possibility of doing all the different bulgings in one die must be considered.

A solution, which immediately presents itself, is to use the final-bulging die and stop off part of this die with lead plugs, *A*, *B*, *C*, *D* for the first, second, third, and fourth bulgings respectively. The fifth bulging is done without a lead plug.

The advantage of this method is the simplicity of equipment needed. If the amount of work of this kind done is not great, it is perhaps the best method that can be employed.

Plugs Not Always Suitable

The disadvantages of the method are:

1. The lead plugs are likely to get chipped and lose their edges, so that in time they do not fit in the die properly.

2. Unless much experimenting is done to find the shapes to which the metal naturally bulges at the various operations and the plugs shaped accordingly, certain stresses will be set up in the metal. Where the piece takes the natural shape, the number of bulgings and annealings can be less.

3. As it is inadvisable to exceed the pressure necessary to do just the required bulging, if the metal of a particular piece being bulged is not properly

annealed, or if it is a little stiffer than the majority, the part may not be bulged sufficiently to fill completely the die at the particular operation. Then, when the partly bulged shell has been annealed and is further bulged, the hydraulic pressure may burst it.

For instance, if the material of a particular piece is stiffer than the majority, the pressure used might only bulge the metal to the line *a*, Fig. 5, instead of up to the lead plug *b*. At the next bulging, after the part has been annealed, the metal, instead of being bulged by the amount *b* to *c*, will be bulged by the amount *a* to *c*, which might weaken the piece.

To prevent bursting or weakening, pieces would require an excessive amount of inspection and corrective work, in replacing parts in the dies when they were not sufficiently bulged at a particular operation, or in increasing the hydraulic pressure so that the pieces would be sufficiently bulged.

The method described below gives control over bulging pressures and the amount of bulging. It enables the use of pressure that will bulge the part a desired amount, not too little as to necessitate too great a number of operations, with annealings between, and not so large as to render the part likely to burst or weaken.

By using a piston to press on the fluid for bulging and controlling the amount of movement of this piston, a certain amount of control may be maintained over the amount of bulging. However, this method is not recommended because of the disadvantages mentioned at the beginning of this article and for various other reasons that develop in practice. One reason is that, to be convenient, a different graduated piston must be used for every different die. The apparatus necessary for the method now to be described can be used for practically all dies. For clarity's sake, principles rather than details of construction will be shown.

Volumetric Control

The end of the shell having been bent as previously mentioned, the piece is inserted in a die as in Fig. 6, and the die closed. The pressure control valve *A* is set to a pressure that is just sufficient to expand the piece slightly, say up to 200 lb. per square in. if the bulging pressure is, say, 1,000 lb. The cock *B* is opened, and the part *C* of the die, into which the piece does not project, will fill with fluid, the air escaping through the glass gage *E*. The cock *B* is kept open until the fluid reaches the basic level *F* in the gage, when it is shut.

The gage *E* is graduated in divisions, representing any convenient volume. For some work, divisions representing cubic inches would be small enough, whereas for the present work fiftieths of a cubic inch are convenient units to use.

If it is considered that for the first bulging the volume of the piece can safely be increased by, say, 0.4 cu.in., then a pointer *G* is moved to opposite this position (20/50ths) on the gage. This setting of the gage of course is done only once for each operation on a batch of pieces.

The increase in volume for the different bulgings is determined by experiment and analysis based on experience. For instance, it is obvious that the volume of the piece can be increased far more at the first bulging than at the second. It is also obvious that the pressure required for bulging will vary.

The pressure control valve *A* is regulated until the pressure is sufficient to start bulging the piece. This fact is indicated by the fluid rising in the gage as the fluid in the die is displaced by the bulging. When the fluid reaches the level indicated by the pointer *G*, the pressure is cut off by the cock *H*.

The die is opened and the piece removed, the fluid in the gage, the die, and the work, draining out into a trough surrounding the table on which the die rests. In this die and the next one to be described, the division of the die is vertical, otherwise air would be trapped, instead of rising through the gage.

When the first bulging operation has been done on all the pieces of a batch, and the pieces annealed, the pointer is reset to the level representing the volume by which the piece is to be increased at the second bulging. Then the second bulging operation is performed as for the first. The fluid is always allowed to rise initially to the same basic level; in this way, the fluid displaced by the part previously bulged is automatically allowed for.

The handle of the pressure control valve moves over a graduated disk indicating the various pressures. A pointer is set opposite the maximum pressure allowable. If the fluid in the gage has not risen to the full height *G* when the maximum pressure is reached, it is an indication that the material is stiffer than most of the pieces, or that it has not been properly annealed. If the fluid is nearly to the required height, then the pressure may be slightly increased to bring the fluid to the right height. But if the fluid is a long way from the height *G*, the piece should be removed and reannealed. Usually, in a batch of several thousand pieces, a dozen or so will be found to require an extra annealing. These can all be handled at once.

With this method of hydraulic bulging, the joint of the die should be made tight to prevent fluid leaks. It is well to arrange all the fluid passages in one half of the die so that there are no awkward joints to make. The entrances of the fluid passages into the die spaces behind the metal being bulged should be kept small, or they should be so arranged that they come on an unimportant part of the piece. In the present example, the particular part where they come is cut away at a later operation. With reasonable pressure, there is little chance of pressing metal into small recesses.

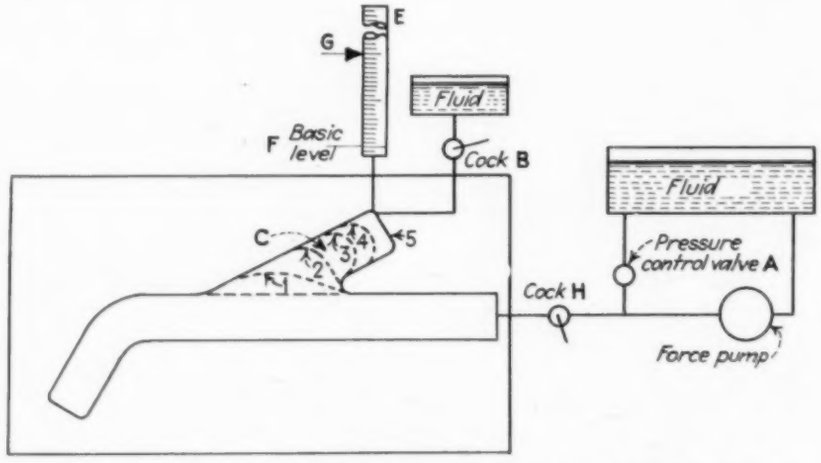


Fig. 6—Fluid gages serve to measure and control the amount of draw

The manufacure of the glove display-stand, Fig. 7, from sheet aluminum alloy forms an interesting example of hydraulic bulging and will serve to show how it is possible by using the method just described to find out what can be done in forming such a piece.

It is practically impossible to say, without experiment, the number of operations required to produce this piece, for the number and variation in the size of the sections makes it difficult to calculate the maximum stress in the material and just where it occurs. If a solid die were

used for each operation, it would necessitate the making of numerous dies before the correct form for each die was found, whereas by using the fluid die method, it is possible by spending a few hours to find just how much bulging can be done between annealings.

A die of the shape of the glove display-stand is connected to two gages and the various fluid passages as shown in Fig. 7. A drawn shell, which has been brought to the shape shown at *A* by hydraulic pressure in a simple die, is inserted. The die is closed, and fluid admitted under a pressure just sufficient to press the metal close to the walls of the die at the sections *X-X* and *Y-Y*. Fluid is now admitted to the thumb and finger spaces to the basic levels in the gages.

Because of the large area of unsupported metal (C × B) opposite the thumb, compared with the unsupported surface opposite each finger, the metal opposite the thumb would bulge first. If the metal bulges into the thumb space, the rest of the metal would not move forward, so it is desirable to prevent the metal from bulging into the thumb, until after the fingers are formed.

To accomplish this, the fluid in the thumb space is prevented from moving by closing the cocks *D* and *H*. The fingers are formed in five operations with an annealing between each operation, each operation being controlled by watching the height of the fluid in the gage *E*. After the fingers have been completed, the thumb is formed in four operations, these being controlled by the gage *F* and the pressure valve.

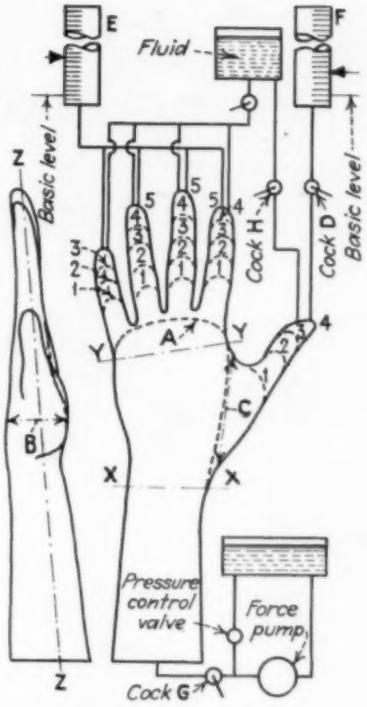


Fig. 7—Drawn from one piece, this glove display stand illustrates the possibilities of fluid dies

Operations Determined By Trial

The number of operations necessary to produce a piece of sufficient strength was found by making several pieces at different numbers of operations, testing these by hydraulic pressure until they burst, and noting the pressures. The number of operations was chosen that gave a piece of the required strength. By similar tests on partly formed pieces, the best amounts of bulging to give at the various operations were also found, and the heights of the pointers on the gages set accordingly.

It would appear that, with the die for the glove stand divided along the line *Z-Z*, it would be impossible to separate the die and remove the formed piece. This is not so, for as one half of the die is being removed, it is slid slightly towards the finger tip, clearing the overhanging part of the fingers. The work is removed from the die half by slightly tilting it.

By fastening another section to the end of the glove display-stand die, a die for a forearm is formed. The fingers and hand are afterwards bent by simple tackle to any desired form, according to the pose which it is desired to give to the shop window model of which the forearm and hand is to be part. It is hardly practicable to do this bending of the fingers and hands in a die, because the number of any one arrangement is not great, the pose of the models varying from that of smoking a cigarette to pulling on a pair of silk stockings. The forearm and hand are given a flesh-colored finish. Other parts of models formed in fluid dies are legs, faces and heads and bodies. The various joints are covered by a pliable flesh-colored material.

It may have been noticed that little mention has been made of the pressures required. This is because the pressures depend upon the metal, the amount of bulging, the shape of the bulge, and the time taken.

Basic pressures for annealed brass 0.020-in. and 0.060-in. thick are about 600 lb. and 1,400 lb. For forcing the metal round bends of small radius or into sections with a small opening the pressures must be greater than for bulging the metal into larger recesses. The longer the time taken to do the bulging, the lower can be the pressure and the fewer the number of operations and annealings. If several different pieces are being formed in different dies, there is little object in rushing the work, for one man can look after several dies, provided that it is arranged for the pressure to be stopped immediately the fluid reaches the height mark in the gage.

While arrangements for exhausting the fluid from the dies, so that it will not run out on the table on which the dies rest, can be provided, they have not been shown because their provision, as with any similar device, depends upon the type of work, the class of labor, and upon other variable conditions.

Are the Railroads Licked? *Discussion*

C. G. WILLIAMS

I would like to know the writer of the article "Are the Railroads Licked?" and to shake hands with him. The railroads will not go out of business, but they will be badly crimped before they are through. All of the cleaning cannot be in the shops, although a very large share can be done there. Some more must be on the right of way and on the trains, and the rest must be on the brains of the higher "ups."

Firstly, they must move freight, and as all income is derived from the movement of freight, that must be the one predominant aim and occupation of the railroads. Passenger movement must be secondary, not primary. The customary average movement of freight in a wheel barrow at some 25 miles per day must stop. It must be moved at from 40 to 50 miles per hour, every hour of the 24 that constitutes a day. No more holding a freight train on a siding for two hours waiting for a passenger train to make that point. Make the passenger train take the siding at all times instead of the freight.

Last week the writer played hobo for a 600-mile trip. It took five hours to cover 65 miles on one road, five hours to cover 122 miles on another road and 6½ hours to cover 142 miles on a third road.

A shipment of meat was split, half going to a truck line and half to a railroad out of Chicago. The meat was delivered to both carriers at 4 P.M. By truck, the meat was delivered at Fond du Lac at 7 A.M. the next day, and at Green Bay, Wis. at 10:30. The railroad delivered its part of the shipment at Fond du Lac 2½ days after receipt, and 3½ days after at Green Bay. (I rode the truck and slept two hours at Milwaukee).

When the railroads clean house, it will mean delivery at 450 miles over night. It can be done, but it will not be done until as the "shop executive" writes, a new set of men manage the railroads. Men who know that their job is not "different."

Marking Sizes and Weights on Automobile Pistons

A. W. DILTS
Inspection Department,
Studebaker Corporation

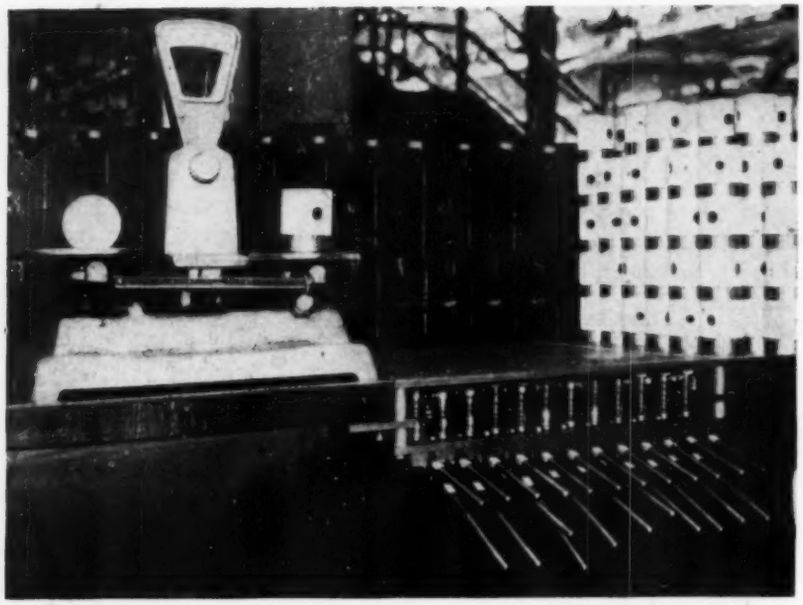


Fig. 1—Each of the 23 handles of the marking machine operates a stencil corresponding to a letter on the balance scale

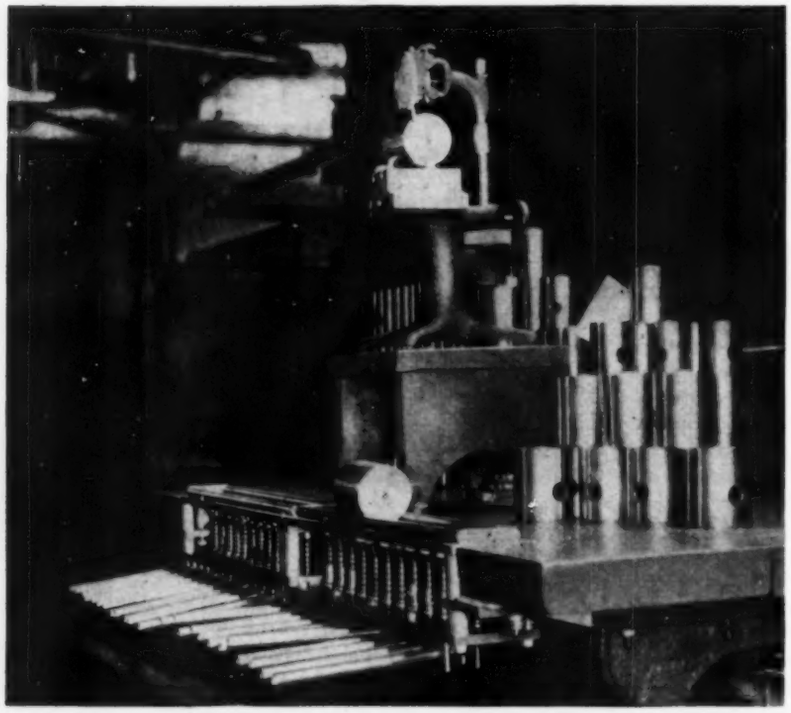


Fig. 2—With two marking machines and a comparator, two types of pistons are sized

THE MARKING machine and system here described were designed, built and put into operation by the writer about a year ago. Our previous practice was to weigh and size the pistons, set them apart in groups according to their various sizes and weights until approximately 200 were accumulated. They were then placed on a fixture holding six or eight pistons and the weight and size stamped on the top with a stencil and hand hammer. Each group of the same weight were stamped with the proper letter or character to insure that every motor had all pistons of the same weight. This system was very slow and pistons occasionally became mixed in handling so that this method was not entirely satisfactory in securing accurate markings of either weights or sizes.

The marking machine shown in Fig. 1 is set into the bench near the balance for weighing the pistons. There are 23 handles or triggers standing out from this machine, convenient for the operator. The inner end of each handle is in contact with a vertical spindle each of which carries a different lettered stencil on its upper end, this being flush with the top of the table or bench. The operator places a piston to be weighed on the balance which has a scale marked in letters to correspond with the stencils of the marking machine. As the balance comes to rest, the operator notes the letter designating the weight of that particular piston. He picks up the weighed piston in one hand and places another piston on the balance with the other. While the balance is coming to rest with the second piston, he places the first one, head end down, over the proper stencil in the stamping machine and pulls the trigger. This draws the spindle down about $\frac{1}{8}$ in. and compresses the spring shown in front. The spindle is then automatically released and the stencil strikes the piston, giving the desired mark. This is done as rapidly as

the operator can handle the pistons and pull the trigger, which automatically returns to its idle position.

The piston is in the hand of the operator from the time it leaves the balance until it is marked, which eliminates all trouble from incorrect marking as to weights or sizes. The white spot shown on each trigger near the bench is an aluminum tag stamped with a large stencil corresponding to the stencil operated by that particular trigger. This is for the convenience of an inexperienced operator but after a short time he becomes as adept as a typist.

Two of these marking machines are seen in Fig. 2. Here we size, by means of a comparator, two different types of pistons which are to be tinned. The size in each case is marked on the body of the piston in the relief near the pin hole and the pistons are located over the stencil by means of the two round bars shown on top of the marking machine. These pistons are rechecked after tinning and the sizes noted to insure the proper thickness of tin on each. The ring grooves are then cut and the tops finished. They are then weighed and marked as before described. After this, they are finally sized in gage rings and the size marked on the top of the piston in a machine similar to the one which marks the weights. All these markings are made before the operator releases the pistion, thus eliminating all mistakes.

Another type of piston is shown in Fig. 3. The sizing rings are at the right. These pistons are passed through the proper ring which determines their size and are immediately placed, head down, on the proper marking machine spindle, which is directly behind each ring. By pulling the trigger, as shown in the front view of this machine in Fig. 4, these pistons are also marked for size before the operator releases them.

These pistons are weighed and marked on a machine similar to that shown in Fig. 1 but having fewer spindles, as the variations in weight do not cover such a wide range.

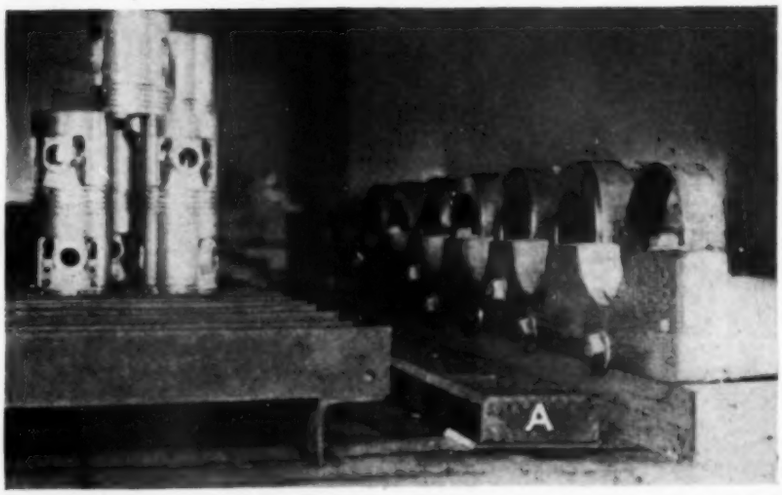


Fig. 3—Sizing rings for a different piston and marking position at *A*

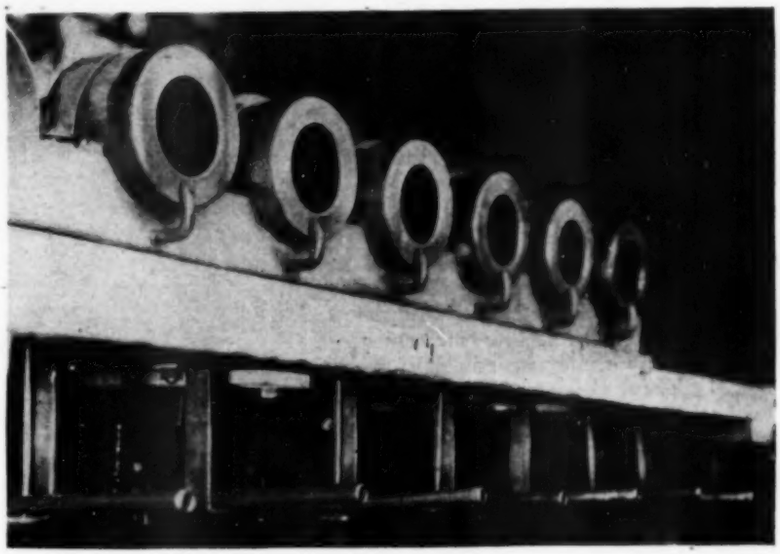


Fig. 4—Front of machine, showing marking levers

Diamond Setting in the Shop

JOHN BOLTON

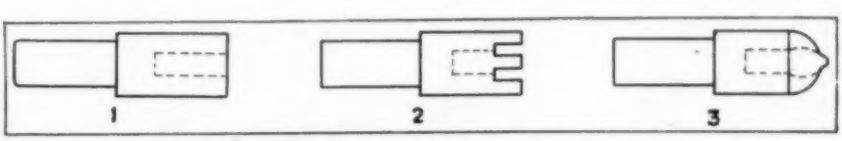
Setting commercial diamonds for shop use is not a common occupation. Having had considerable experience in this work I am glad to pass on the method used to those who may have to set a diamond occasionally.

Take a piece of ½ in. round cold rolled steel about 1¾ in. long and turn one end to fit the holder which will usually be about ⅜ in. diameter by ⅞ in. long. A bench lathe is handy for this work.

With a ⅛ in. drill put a hole about ⅝ in. deep in the other end and fill the hole with brazing metal as in the left-hand view. Put the piece back in the bench lathe, center, and drill to suit the diamond to be set. For a 3-carat stone the hole should be about ⅛ in. in diameter and ¼ in. deep as shown in the center.

Slit the end of the holder with a hack saw, making 6 cuts, and file away 3 of the prongs, leaving the other 3 to act as claws to hold the diamond. Put the stone in place and close the prongs over the stone taking care not to hit it or to grip it too tightly. With the blow torch fill around the stone with brazing metal. Put the holder in the vise and locate the diamond by using a file very gently. Then turn the point as at the right, taking care to keep the tool from touching the diamond, or the stone will probably fracture.

Always make the first or "core" hole smaller than the stone to be set, or it will shift in brazing as it floats on top of the brazing metal. I find that this method gives better results than others if the precautions noted are carefully followed.



These three steps are taking in the proper preparation of the holder and the setting of the diamond

Contour Calculations for Forming Tools—VIII

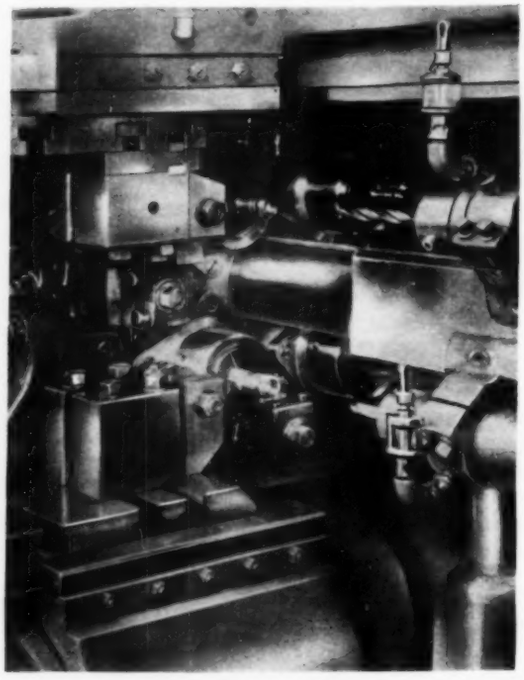
O. A. JOHNSON
Chief Tool Designer,
Tyson Roller Bearing Corporation

Circular facing tools and a method of tabulation to simplify procedure on all types of tools are covered in this installment

ANOTHER type of forming tool is the circular facing tool, feeding parallel with the center line of the product with the center line of the tool perpendicular to the center line of the work. Depending on the shape of the product, a tool, setting at an angle and yet feeding parallel to the center line of the work, may sometimes be required. These tools may be internal or external and the same procedure may be used as explained in Articles VI and VII for calculating the tool profile.

We shall now calculate a circular tool for finish forming the end of the part shown in Fig. 51. If we consider this part, we will notice that dimension *A52* is just an undercut for clearance and not of paramount importance as far as depth is concerned. Therefore the important points to consider when deciding upon the method of grinding the rake angle of the tool, are points *P1*, *P2*, *P3* and *P4*.

If we let the tool cut on center of work at *P1* and grind the rake angle parallel with the center line of the tool, *P2* on the tool would be below center of work. Point *P2* on the product is, however, the exact center of work, and therefore the tool must cut on center at this point. To accomplish this, the rake angle on the tool must be ground at an angle with the center line. It would be impossible to let *P2* cut on center and grind the rake angle parallel with the center line, because then there would be no clearance for the tool at radius *A50*. Fig. 52 is the end view of the product, showing the points of the tool in finished position. Fig. 53 is the end view of the tool in finished position, and Fig. 54 is a layout of the tool profile.



A circular forming tool is held in the square toolpost of a Gridley four-spindle automatic

$K1$ = periphery clearance angle
$K2$ = rake angle
$K1 + K2 = K3$
$A34 \times \sin K2 = K4$

$$\frac{K4}{A45} = \tan K5$$

$K5$ = vise angle
$K6$ = radius of tool at $P1$
$K6 \times \cos K1 = K7$
$K7 - A34 = K8$
$K6 \times \sin K1 = K9$

$$\frac{K9}{K8} = \tan K10$$

$$\frac{K8}{\cos K10} = K11$$

$K11$ = radius of tool at $P2$

$$\frac{K4}{\cos K2} = K12$$

$K12 + K9 = K13$

$$\frac{K13}{K8} = \tan K14$$

Fig. 52—An end view of the product which shows the points of the tool in finished position

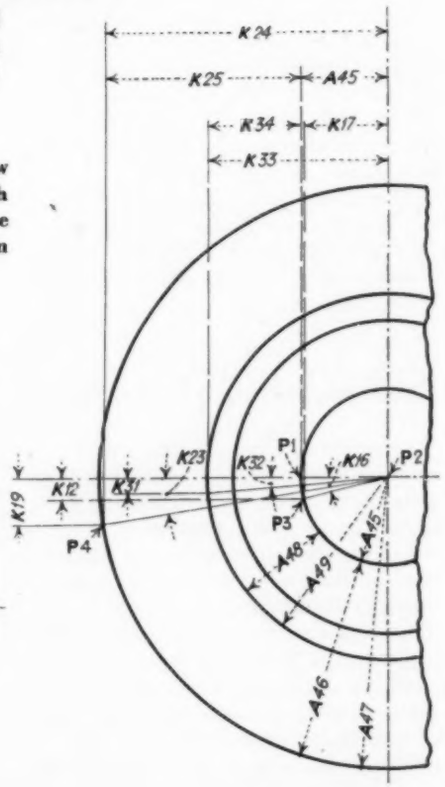
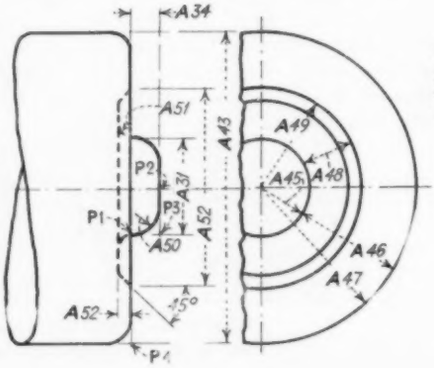


Fig. 51—Work with an end contour as illustrated may be efficiently turned with a circular facing tool



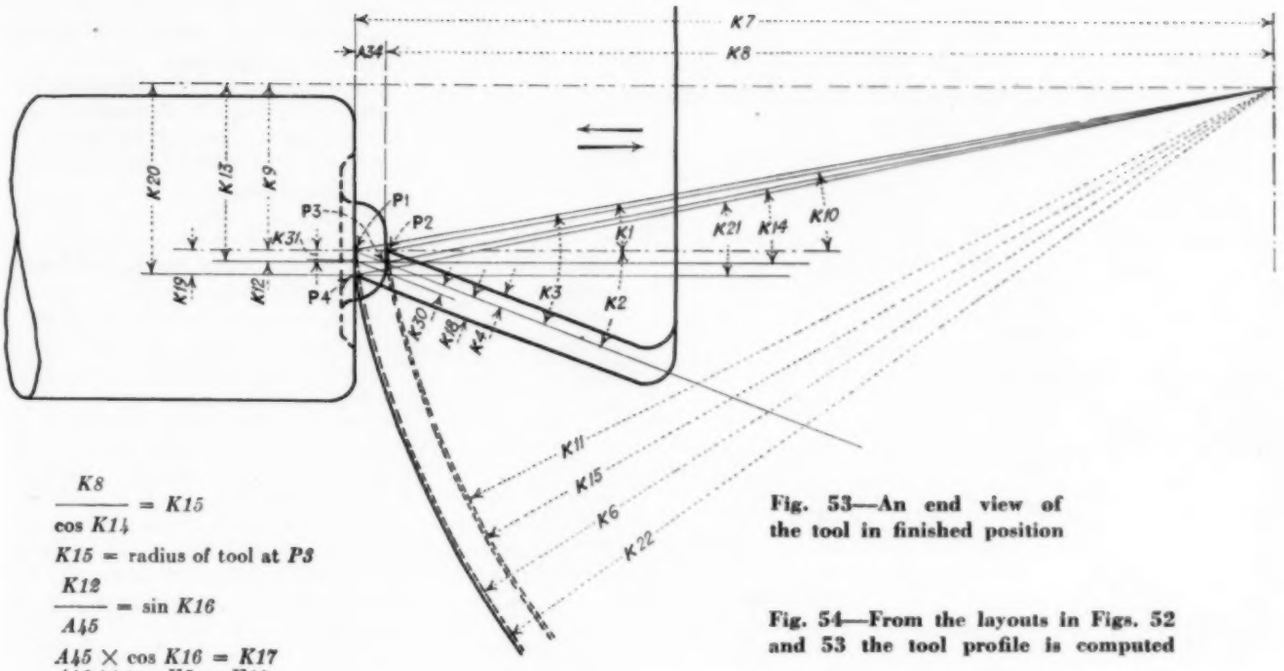


Fig. 53—An end view of the tool in finished position

$$\frac{K8}{\cos K14} = K15$$

$K15$ = radius of tool at $P3$

$$\frac{K12}{A45} = \sin K16$$

$A45 \times \cos K16 = K17$
$A46 \times \tan K5 = K18$

$$\frac{K18}{\cos K2} = K19$$

$K19 + K9 = K20$

$$\frac{K20}{K7} = \tan K21$$

$$\frac{K7}{\cos K21} = K22$$

$K22$ = radius of tool at $P4$

$$\frac{K19}{A47} = \sin K23$$

$A47 \times \cos K23 = K24$
$K24 - A45 = K25$
$K15 - K11 = K26$

$$\frac{K26}{K17} = \tan K27$$

$K22 - K6 = K28$

$$\frac{K28}{K25} = \tan K29$$

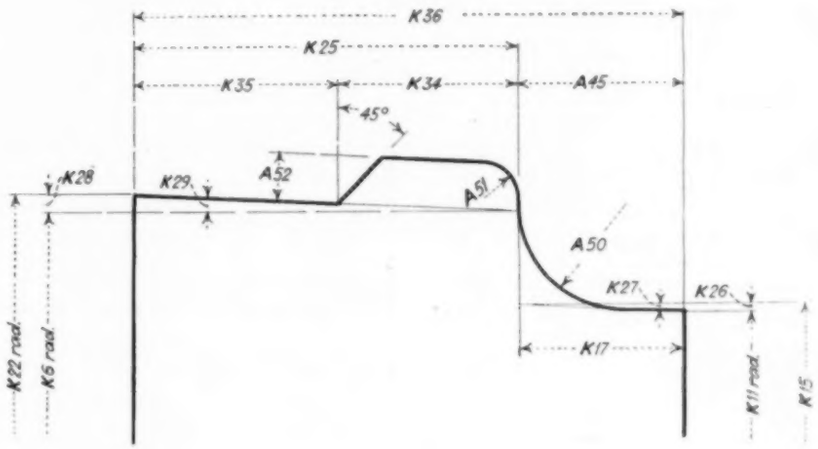
$A48 \times \tan K5 = K30$

$$\frac{K30}{\cos K2} = K31$$

$$\frac{K31}{A49} = \sin K32$$

$A49 \times \cos K32 = K33$
$K33 - A45 = K34$
$K25 - K34 = K35$
$K35 + K34 + A45 = K36$

Fig. 54—From the layouts in Figs. 52 and 53 the tool profile is computed



In the preceding articles, we have described the methods for calculating different kinds of forming tools. Now we shall explain how these methods may be converted to formula sheets, making it possible for anyone having a fair knowledge of logarithms to calculate a forming tool.

If there are two or more tools, having the same contour but different dimensions to be calculated, a formula sheet should be made on tracing cloth. Fig. 5 shows a formula sheet for the tool described in this article.

As a rule, any product requiring a calculated forming tool is held to close tolerances so that product gages are required. It is then advisable to calculate such gages on a formula sheet also. All product dimensions necessary for the tool calculations, that can be calculated without any tool data, should be given given characters of the same kind with different numbers to distinguish them, *A1, A2, A3*. Then if more than one tool is required, each tool should be given its own character, as *B1, B2, B3; D1, D2, D3; E1, E2, E3*, etc.

In the margin of each column, references are given to save time in looking up the logarithms of the different numbers and angles. *K12* in the margin means that while we have the book open to look up log sin *K2*, we can at the same time put down log cos *K2* in *K12*. *K9* in the margin means that while we look up log cos *K1* we can also put down log sin *K1* in *K9*. *K7* in the margin means that log *K6* has already been looked up in *K7*. *K11* means that the log cos *K10* may be put down in *K11* before the book is closed. These references save much time, especially when three different functions of an angle are wanted.

To obtain the best results from a circular forming tool, the clearance angles and rake angles must be properly selected. As the shape and the size of work, and also the feed angle of the tool, are all major factors in determining the periphery clearance for a circular forming tool, no angle can be fixed that will be satisfactory for all cases. Experience and a little sound judgment will tell just what to make this angle for each

CIRCULAR FACING TOOL FOR ROLLS

Figured by – R. H. Date – 8-13-32 Roll No. 15,000
Checked by – O. A. J. Date – 8-15-32 Machine – $\frac{7}{8}$" Gridley Auto.

K1	Periphery clearance +	= 10-0-0	
K2	Rake Angle	= 20-0-0	
K3		= 30-0-0	
	Log A34	= 8.4623980	
	» sin K2 +	= 9.5340517	K12
K4		= 7.9964497	
	Log A45	= 8.6711728	
	» tan K5	= 9.3252769	
	Vise angle,	1040 1913	
K5	↪ = 11-56-28	856	
K6	Rad. of tool @ P1 →	= .96875	
	Log K6	= 9.9862117	
	» cos K1 +	= 9.9933515	K9
	» K7	= 9.9795632	
		5620	
K7	= .95403	12	
A34	= .02900		
K8	= .92503		
	Log K6	= 9.9862117	K7
	» sin K1 +	= 9.2396702	
	» K9	= 9.2258819	
	Setting height,	8776	
K9	↪ = .16822	43	
	Log K9	= 9.2258819	K9
	Log K8 –	= 9.9661558	
	» tan K10	= 9.2597261	
		1197 6678	
K10	= 10-18-25	583	K11
	Log K8	= 9.9661558	K10
	» cos K10 –	= 9.9929348	
	» K11	= 9.9732210	
	Rad. of tool @ P2	2202	
K11	↪ = .94020	8	
	Log K4	= 7.9964497	
	» cos K2 –	= 9.9729858	
	» K12	= 8.0234639	
K12	= .01056		
K9	+ = .16822		
K13	.17878		
	Log K13	= 9.2523189	
	» K8 –	= 9.9661558	K10
	» tan K14	= 9.2861631	
		1130 596	
K14	= 10-56-19	1035	K15
	Log K8	= 9.9661558	K10
	» cos K14 –	= 9.9920368	
	» K15	= 9.9741190	
	Rad. of tool @ P3	1154	
K15	↪ = .94215	36	
	Log K12	= 8.0234639	K12
	» A45 –	= 8.6711728	K5
	» sin K16	= 9.3522911	
		911 2704	
K16	= 13-0-22	207	K17
	Log A45	= 8.6711728	K5
	» cos K16 +	= 9.9887132	
	» K17	= 8.6598860	
	P2 to P3 ↪		
K17	= .04570		
	Log A46	= 9.0374265	
	» tan K5 +	= 9.3252769	K5
K18		= 8.3627034	
	Log cos K2 –	= 9.9729858	K12
	» K19	= 8.3897176	

K19	= .02453		
K9	+ = .16822		
K20	= .19275		
	Log K20	= 9.2849944	
	» K7 –	= 9.9795632	K7
	» tan K21	= 9.3054312	
		1085 3268	
K21	= 11-25-20	1044	K22
	Log K7	= 9.9795632	K7
	» cos K21 –	= 9.9913122	
	» K22	= 9.9882510	
	Rad. of tool @ P4	2467	
K22	↪ = .9733	43	
	Log K19	= 8.3897176	K19
	» A47 –	= 9.1928461	
	» sin K23	= 9.1968715	
		1322 8507	
K23	= 9-3-12	208	K24
	Log A47	= 9.1928461	K23
	» cos K23 +	= 9.9945557	
	» K24	= 9.1874018	
		3797	
K24	= .15396	221	
A45	= .04690		
K25	P1 to P4 → = .10706		
	K15	= .94215	
	K11 –	= .94020	
K26		= .00195	
	Log K26	= 7.2900346	
	» K17 –	= 8.6598860	K17
	» tan K27	= 8.6301486	
K27	= 2-26-37		
	K22	= .97331	
	K6 –	= .96875	
K28		= .00456	
	Log K28	= 7.6589648	
	» K25 –	= 9.0296272	
	» tan K29	= 8.6293376	
K29	= 2-26-20		
	Log A48	= 8.6989700	
	» tan K5 +	= 9.3252769	K5
K30		= 8.0242469	
	Log cos K2 –	= 9.9729858	K12
	» K31	= 8.0512611	
K31	= .01125		
	Log K31	= 8.0512611	K31
	» A49 –	= 8.9863238	
	» sin K32	= 9.0649373	
		1801 8057	
K32	6-40-7	1316	K33
	Log A49	= 8.9863238	K32
	» cos K32 +	= 9.9970517	
	» K33	= 8.9833755	
K33	= .09624		
A45	– = .04690		
K34	= .04934		
	K25	= .10706	
	K34 –	= .04934	
K35		= .05772	
	K34	+ = .04934	
	A45	+ = .04690	
K36		= .15396	

Fig. 55—Tabulation with cross references will greatly facilitate the calculations

individual case. We can, however, give some simple rules, that will be helpful in determining this angle:

1. For external tools feeding at 90 deg. to the center line of the product, and when the greater part of the profile to be formed is parallel to the center line or at a slight angle, the clearance angle should not be over 5 deg. As the greater part of profile approaches a 10-deg. angle with a line perpendicular to the center line, the true periphery clearance decreases and may be adjusted by increasing the clearance angle, not to exceed 12 deg. (See angle *A* Fig. 33 in Article V.).

2. For external tools feeding at an angle, the clearance angle should in no case be less than 10 deg. As for tools feeding at 90 deg., the true periphery clearance may be increased by making the clearance angle larger, which in no case should be greater than 14 deg. An angle of 12 deg. will be sufficient for most cases.

3. For internal tools feeding at 90 deg., the clearance angle should never be less than 10 deg. This angle may be increased to 13 deg. for conditions described in Case 1.

4. For internal tools feeding at an angle, the clearance angle should not be less than 12 deg. and may be increased to 15 deg. as for conditions described in Case. 2.

Under ordinary circumstances, the rake angle should be about 25 deg. for soft steel, decreasing for harder steel. A 20-deg. rake angle will work satisfactorily in most cases. The rake angle is dependent not only on the hardness of the steel, but also on the feed and the shape of the product. As for the clearance angles, the rake angles also are best determined through experience.

Change Gears for Gear Cutting
Discussion

W. H. RASCHE
Professor of Mechanism, Virginia Polytechnic Institute

The process explained by T. R. Rideout for calculating change gears (*AM*—Vol. 76, page 999) was exhaustively treated about six years ago in Bulletin No. 2 of the Engineering Experiment Station of the Virginia Polytechnic Institute. This bulletin, of 111 pages, contains not only a detailed explanation of the process in question, but also a corrected copy of the Brocot table of decimal equivalents and the statements and proofs of ten algebraic theorems.

I regret to have to state that no copies of this bulletin are now available, the issue of 500 copies being exhausted. The bulletin can be consulted, however, in most of the principal libraries.

Statistical Control In Sampling Inspection

H. F. DODGE
Bell Telephone Laboratories

Practical examples of the application of the inspection criteria of attributes and variables to production control and customer protection

(*Concluded from page 1088*)

IT IS probably of interest to discuss briefly the importance of getting the most out of a given amount of data. (See August, 1932 Report of Joint Committee sponsored by the American Society of Mechanical Engineers and the American Society for Testing Materials on the Development of Applications of Statistics in Engineering and Manufacturing. To be published in Mechanical Engineering, November 1932). This is a problem that is particularly important when samples must be small in number because of the cost of making tests or because of the destructive nature of the test. Testing the tensile strength of strand is an example.

Let Fig. 9 represent the distribution of tensile strength for "6,000-lb." strand. Suppose that a sample of ten test specimens from a homogeneous lot are subjected to the standard test, yielding a corresponding number of measured values. How may we judge from the sample whether the quality of the lot is satisfactory? There are, generally speaking, two different methods of interpreting these data:

(a) Method of Attributes—in which the inspector merely notes whether the individual observations do or do not fall below the minimum specified;

(b) Method of Variables—in which the inspector makes use of the numerical magnitudes of the individual observations, and computes certain statistics of these observations, such as their average and their standard deviation.

It is probably self-evident that by the latter method, more information will be obtained. But what increase in value can we attach to the method of variables from the point of view of protecting the consumer against receiving unsatisfactory material? This will be illustrated by taking a specific case and setting up two alternative arbitrary criteria, which must be satisfied in order that a lot may be considered acceptable for use.

A criterion commonly used in inspection by the method of attributes is to accept the lot if none of the test specimens has a tensile strength below the specified minimum limit. We will take this as our criterion:

Attributes Criterion—Accept lot if no test specimen falls below the minimum limit.

For the method of variables, any one of a number of criteria might be established. We will assume that the characteristic nature of trouble, when it does occur, is a shifting of the average, indicated by the lower two diagrams of Fig. 9, rather than a change in the shape or spread of the distribution. Our choice of criterion and hence our result will depend upon this assumption. For purposes of illustration, the criterion will be set up in the manner indicated by Fig. 10. First, we will establish a *limiting distribution*, represented by the heavy curve, by shifting to the left the distribution curve for normal output (Fig. 9) so that its lower extremity just touches the specified minimum limit. This limiting distribution has an average X of 6,960 lb., and a standard deviation σ of 320 lb., the latter being the value which is normally expected, as determined from past experience. Then, we will set as a criterion for acceptance a minimum limit to be met by the average of the observations in any sample, making this limit equal to the lower (3σ) limit for averages of random samples drawn from this limiting distribution. Symbolically, this limit is

$$\bar{\bar{X}} - 3\sigma_{\bar{X}} = \bar{\bar{X}} - \frac{3\sigma}{\sqrt{n}}$$

where n = number of test specimens in the sample, and we have as our criterion:

Variables Criterion—Accept lot if the average of the observations for the sample is not less than

$$\bar{X} - \frac{3\sigma}{\sqrt{n}}$$

How this varies with sample size, n, is shown in Fig. 11.

Now, let us compare the degree of protection that will be afforded by using these two criteria of acceptance, when lots of different quality (different averages but same standard deviation) are

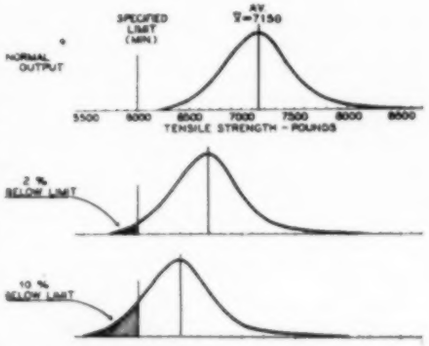


Fig. 9—Distribution of tensile strength—6,000-lb. strand

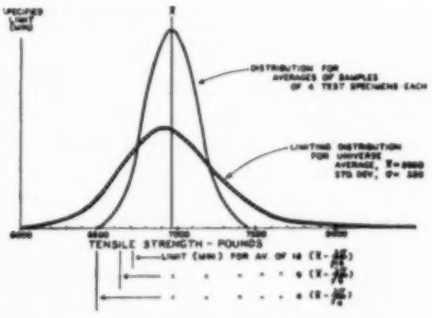


Fig. 10—Theoretical basis for setting variables criterion, tensile strength—6,000-lb. strand

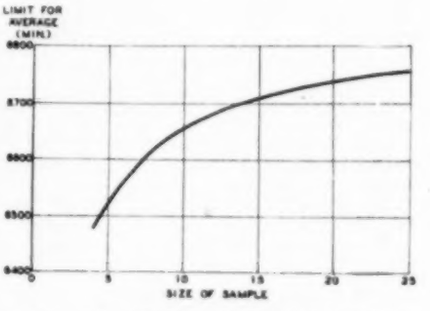


Fig. 11—Graph of variables criterion—to be met by the average of a sample

submitted for acceptance. The results, based on the use of Normal Law probabilities, are indicated in Fig. 12. If four test specimens are tested for each submitted lot, then if a 10 per cent defective lot is submitted (one having 10 per cent of its distribuion below the limit), the chances are 65 in 100 that none of the four specimens will have a tensile strength of less than the specified minimum limit. This means that if the attributes criterion were used as a basis of acceptance, the probability of accepting a 10 per cent defective lot of strand would be 0.65. On the other hand, if the variables criterion were used for the sample of four test specimens, the probability of accepting a 10 per cent defective lot would be only 0.33. Likewise, a 20 per cent defective lot would be passed as satisfactory 41 times in 100 if the attributes criterion were used and only 10 times in 100 if the variables criterion were used. The difference in protection afforded is even more pronounced for larger samples. Obviously, the risk that the consumer takes is vitally dependent on the kind of criterion that he uses.

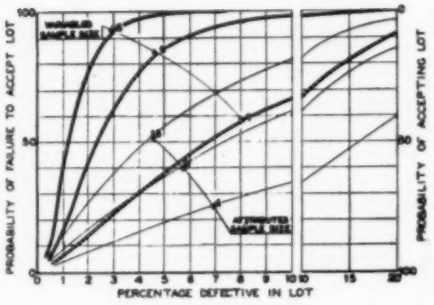


Fig. 12—Comparison of protection afforded by the attributes and variables criteria

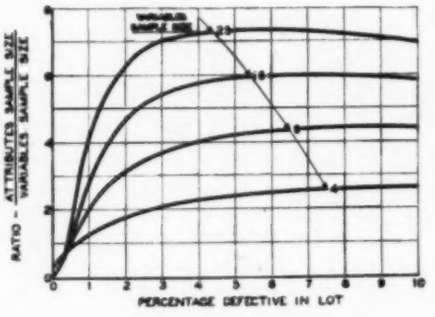


Fig. 13—Relative size of sample required for the same protection

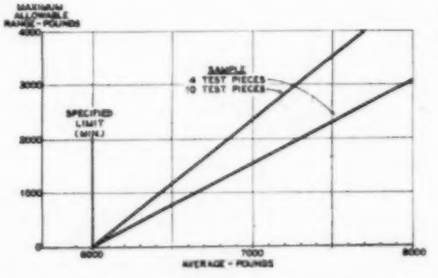


Fig. 14—The "average-range" criterion—tensile strength, 6,000-lb. strand

Equal Consumer Protection

Perhaps a more striking comparison can be made by considering the relative size of samples that would have to be inspected using these two alternate criteria, in order to give the *same protection to the consumer*. This is shown in Fig. 13. From the curves we note that for identical protection, a sample of four using the variables criterion would be equivalent to a sample of approximately ten using the attributes criterion, over a substantial range of values of percentage defective. Likewise, a sample of nine, using one method of interpretation would give the same protection as a sample of 35 to 40, using the other method of interpretation.

Using p, the fraction defective, as the sole basis of judging the quality of a lot, rather than the statistics of the distribution of observed values for the sample, such as the average and the standard deviation, is under most circumstances equivalent to throwing away a bulk of the information that is made available by the results of inspection. It may be argued that the expense and difficulty of requiring the computation of such things as averages and standard deviations is too great under practical conditions to warrant their use. This argument is sound only provided the cost of testing an appreciably larger number of test specimens is less than the cost of making one or two relatively simple computations.

The above illustration has been given merely to indicate one way in which an advantage may be gained by making efficient rather than inefficient use of sampling data. The particular acceptance criterion for variables used in the example was, of course, an arbitrary one. While extremely simple, it is nevertheless one that is applicable under certain conditions. There are many other variables criteria that might be chosen, involving the average alone or the average and standard deviation jointly. For example, one that has proved to be quite satisfactory (Fig. 14) and easy to use in practice provides a maximum allowable "range" for each magnitude of observed average, where the range is the difference between the largest and the smallest observation in the sample and is used as an estimate of the standard deviation. For example, if four test specimens from a lot of strand give breaking strength values of 7,130, 6,220, 6,960 and 7,530 lb., the inspector's analysis of the data would consist in finding the average of these values, 6,960, and the range, 7,530 — 6,220 = 1,310. For an average of 6,960 lb., the chart gives a maximum allowable range of 1,500 lb. Since the observed range 1,310 is less than 1,500, the lot should be accepted.

Such variables criteria, can, of course, be used as substitutes for the usual attributes criteria of "no defects," or "not more than m defects in the sample." But they are often considered as particularly adaptable for use as supplementary criteria for judging the results of a first sample and for determining when a second substantially larger sample should be inspected before rejecting a lot. When used in this way they can be employed either for the purpose of increasing the protection to the consumer (decreasing his risk) or as a sound basis for decreasing the size of sample required for a given protection.

It should be pointed out, however, that the degree of protection afforded by any sampling plan or the relative efficiency of different plans can be evaluated in the manner just described only when the material represented by samples or by ear-marked sub-samples is homogeneous in quality. This indicates the need for "statistical control" of quality wherever sampling inspection is used.

Control—A Basis for Reducing Consumer Inspection

While inspection for purposes of protection is very important, this phase of the sampling problem has perhaps been overemphasized.

For what reason may a regular consumer of a quantity product wish to make a thorough inspection of each lot submitted to him? Primarily because he is afraid that lots of unsatisfactory quality may be submitted once in a while. This attitude testifies to his lack of confidence in the uniformity of the quality turned out by the producer. If a feeling of greater confidence could be established, then and only then could he feel safe in reducing the extent of his inspection. The question arises as to just how such a situation can be established. Everything rests on a cooperate program entered into by the producer and the consumer in which the producer so regulates his processes that he can demonstrate consistent success in controlling quality at levels satisfactory to the consumer. This appears to be the answer. But how far can we go in this direction?

The consumer wants a product that will give maximum service at minimum

cost. Dependability in service rests to a large extent on good design and uniformity of quality. For a continuous production process the utmost in uniformity would be obtained with a single constant system of chance causes, such that all portions of the product would constitute but a single homogeneous stream—the edge strips of sheet brass (Fig. 8) having the same physical properties as the center strips, all having the same variability along the length. An economic standard of quality for some characteristics may properly require this degree of uniformity in the output, while for others, in recognition of the physical nature of current manufacturing technique, it may permit known systematic differences between portions of the output—sheet brass whose quality at the edges differs from that at the center because of elasticity of the rolls; change in pitch and outside diameter of screws, resulting from wear of tools in the elapsed time between set-ups of a screw machine.

Under these conditions the producer's control program would have as its aim the control of quality of several streams or sub-portions of product, each at some definite level, not necessarily the same as for other sub-portions. The program would include:

(1) Continuing producer inspection of the output of each sub-portion, adequate in extent to uncover quickly any trends or abnormal shifts in quality levels;

(2) Use of control charts (Fig. 15) or their equivalent, with control limits (dotted lines of Fig. 15) that may be used as criteria for indicating lack of control and the need for corrective action;

(3) Weeding out causes of trouble in the process when they occur and setting up measures to prevent recurrence.

Suppose the producer has succeeded in carrying out such a program? So far as quality variation is concerned, the successive lots from any controlled subportion of the output may then be regarded merely as large samples from the universe. Any inspection samples drawn from those lots may in turn be regarded merely as smaller samples from the universe. Measurements either on complete lots or on samples may be taken to reflect the effects of the entire production cause system. Thus with the attainment of control, the need for extensive inspection by the consumer is diminished—he need make only such inspections as he may deem adequate to assure himself that the producer's control continues effective. The amount of inspection required for this purpose is sharply less than that needed to provide positive protection in the face of erratic control. Depending on circumstances, the consumer may elect either

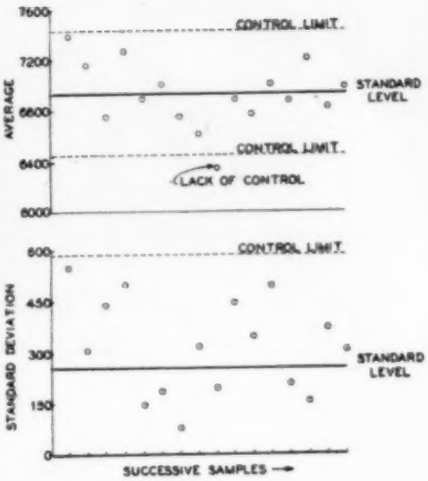


Fig. 15—Typical control charts for tensile strength of strand—each sample, four test specimens

to reduce the size of sample from each lot or to substitute a periodic inspection for the usual lot-by-lot inspection.

Conclusion

The development and application of what might be termed scientific methods of sampling inspection rests first and foremost on the introduction by the producer of a program of statistical control, covering each step of the process from raw materials to finished product. Such a program cannot be realized suddenly but must come through comprehensive planning which has as a keynote the application of statistical methods to the specification of economic standards of quality and to the inspection criteria that are to be used as practical interpretations of those standards. Progress in use of efficient sampling inspection methods will go hand in hand with progress in the application of statistical control principles by the producer.

Correction—A footnote, first part of the article (AM—Vol. 76, page 1085) stated incorrectly that the material was presented before the A.S.M.E., Atlantic City, June 20. It should have read A.S.T.M.

How High a Helix?

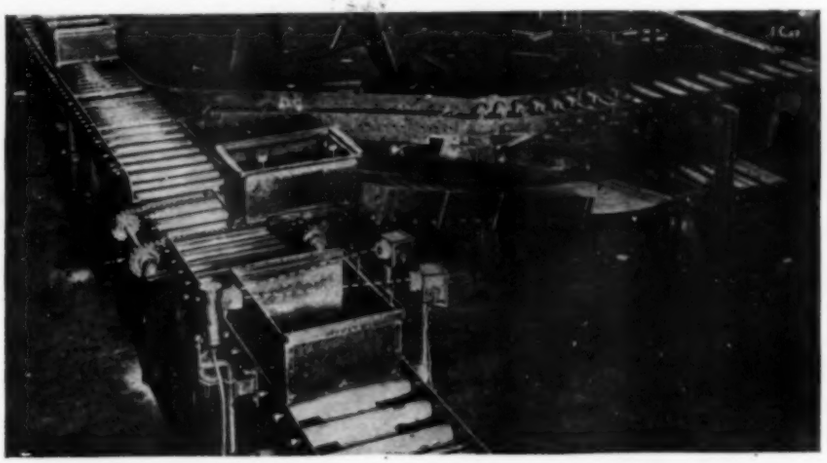
FRANCIS W. SHAW
Gear Consultant, Heywood, England

Godfrey's note (*AM*—Vol. 76, page 473) reminds us that much is still obscure on the subject of helical gears.

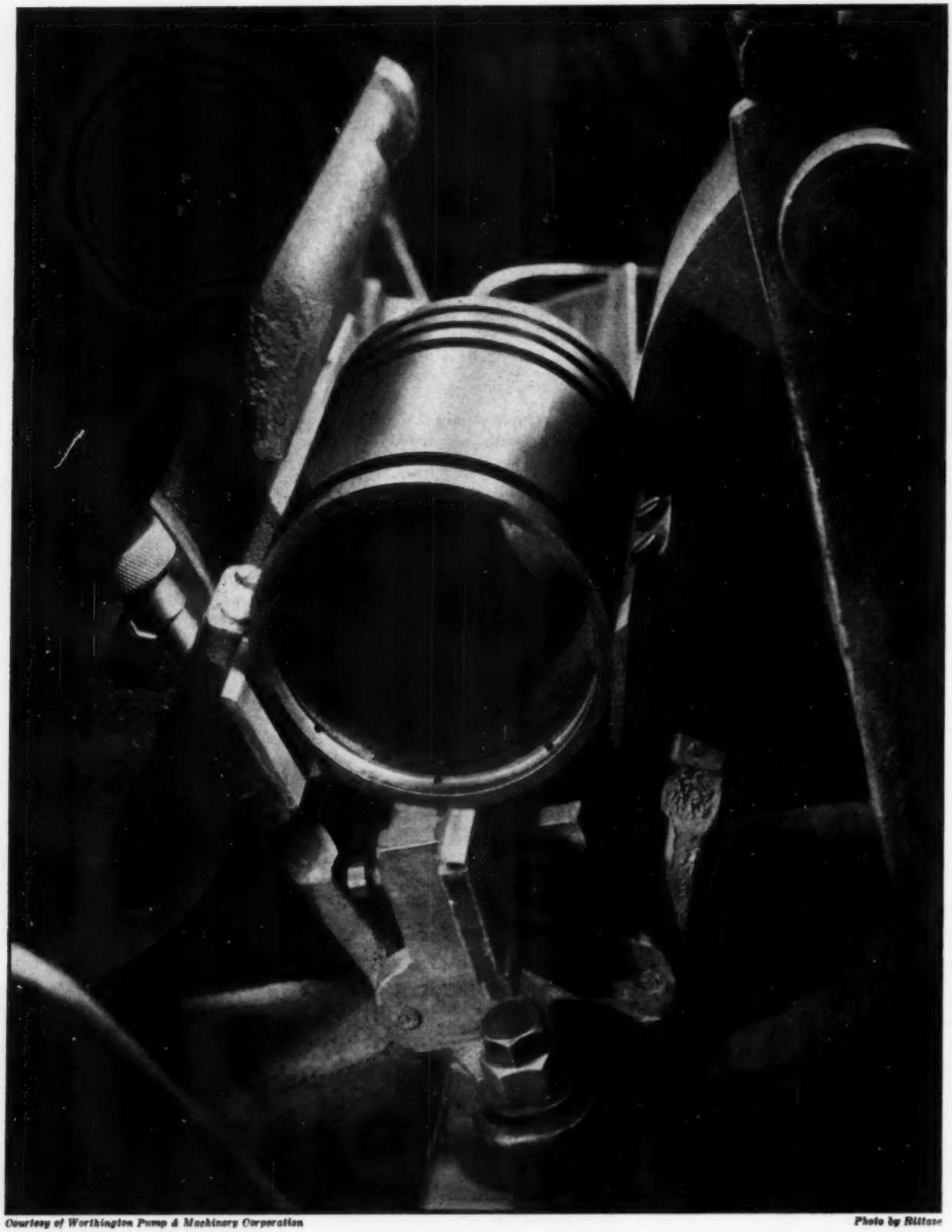
While there is little doubt that less noise goes with the higher helix angle, there is as little doubt that higher angles connote reduced efficiency. One purpose of "helicizing" gears is to minimize impact, and impact can be reduced nearly as much by a low angle as by a high.

I have occasionally cut both helical and spiral bevel gears with teeth of what has been termed "half-pitch spirality," getting excellent results. Thus, a gear of 1-in. face and ½-in. circular pitch would be cut to a helix angle whose tangent was ¼ in. instead of the ½ in. called for by its width of face.

In cutting spiral bevel gears on that type of machine in which the cutter (of planer type) reciprocates across the face of the blank as this rotates continuously at constant speed, "half-pitch spirality" enables the tool to operate on successive instead of alternate teeth, saving indexing when a gear is to have an even number of teeth, and obviating the possibility of half the teeth being thicker or thinner than the other half.



Here is how General Electric photoelectric relays are used by the Logan Conveyor Co., Louisville, Ky. for preselective dispatching of boxes on conveyors. Small targets replace the usual pins, and electrical contacts take the place of mechanical switching devices



Courtesy of Worthington Pump & Machinery Corporation *Photo by Rittase*

Round without a center,

fed without a feed

EDITORIALS

AMERICAN MACHINIST
VOLUME 76 ESTABLISHED 1877 NUMBER 35
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K. H. CONDIT F. H. COLVIN
EDITORS

Let's Get to Work

Since July last this country has been in the throes of a major political campaign. The vicissitudes and uncertainties of this campaign have undoubtedly delayed the normal economic recovery. It is most hopeful to note, however, that business has progressed, unemployment has diminished, commodity prices have advanced in the face of these unsettling influences.

During the heat of a partisan campaign statements were made that were purposely extreme to give them greater emphasis. Both major political parties announced that the success of their opponents would be decidedly detrimental to economic recovery. Even business leaders having no personal interest in the political prizes at stake and acting undoubtedly in the light of their own best judgment issued statements which were drastic in their condemnation of one party or the other. But all this is traditional political oratory, most of it best forgotton.

All through this turmoil the wise heads have been giving most of their thought to adjusting themselves and their organizations to current conditions. That it has paid to do so is evident from third quarter reports that are now appearing. Company after company is showing a profit on far less business than that conducted a year ago at a loss.

We believe that it is the duty of every man, particularly if he is in any kind of executive position, to take an active interest in politics and civic affairs. So long as this country preserves its democratic form of government, it can go forward only if its citizens do their part in working for better government.

At the same time we believe that no government, democratic or autocratic, can exist very long if its people are not in good shape economically. Therefore, the primary duty of every business man and industrialist, now that the election is over, is to promote his own business vigorously and intensively.

Hidden Values and Real Costs

Capitalism is based on the sale of products at a profit, the profit having the double purpose of affording both an incentive and a fund for research and development. Without a surplus over the actual costs of management, labor and material and plant overhead, there can be no further progress.

Many large concerns, however, seem to overlook the necessity for profit on the part of those who supply them with equipment. Knowing the cost of producing machinery in quantity, they seem to expect to buy special machines on the basis of its cost to the maker, and without the profit which they know is necessary for further development. This attitude is especially true of makers of consumer goods, who do not seem to appreciate the problems of makes of capital or production machines which make possible the low cost of their product.

Real value in machine equipment probably bears less direct relation to the visible costs than almost any other product. Cost of material and labor may only represent a few hundred dollars on a machine that costs thousands. But behind these lie years of research and experience, thousands of dollars spent in the development of earlier models, as well as the capacity of greatly reducing the cost of the product made by the equipment.

An appreciation of these hidden values and costs would remove much of the friction that sometimes develops when the purchase of new production machinery is being negotiated. If the purchaser, who will, if the equipment is wisely chosen, benefit long after any profit of the builder has been spent in new development work, could be made to realize the unseen cost of engineering and development there would be far less criticism, haggling and hesitation in placing orders. This would incidentally appreciably reduce the cost of selling and enable a machine to be priced at a lower figure, while maintaining the margin necessary for further development work.

Profits being vital under the system which we believe to be necessary for further growth of the business world, it behooves purchasers to remember that they are just as much needed by the seller as by themselves. Unless a transaction benefits both parties there can be no real prosperity. Machine value must be judged not only by its actual physical cost to the builder but by all the factors that made its construction possible as well as the savings it can effect for the user.

"We Have Just Declared a Dividend"

Some boards of directors never knew anything, don't know anything, and never will know anything about the manufacturing businesses they are supposed to direct, or else they are treading painfully close to the line between ethical conduct and deceit. This sounds like a strong indictment but it is justified by an incident that has just occurred.

A machinery salesman called on a customer who was badly in need of replacement equipment. His old machines were in no shape to meet production

demands that might come at any moment. But the superintendent had this reply to make to the salesman's solicitation: "You are just wasting your time trying to sell us any machinery. We have just declared a dividend out of our depreciation reserve.

"What makes me so sore," he went on to say, "is that hardly a man in this plant is working more than six days a month. That's the worst thing, of course, but I can't possibly meet the schedules and prices we are quoting so long as my equipment is in its present terrible condition. I had counted on that reserve to buy some machines that we simply can't do without. And we go and declare a dividend instead!"

This is no new story to most of us, unfortunately. We have all seen instances of this type of management before. But wouldn't you think that in these times even the dumbest directorate would have more sense, and a greater feeling of responsibility to their employees and to the ultimate interests of their stockholders?

• CHIPS •

October business was better . . . November holds promise in spite of political disturbances . . . carloadings and soft coal production pass seasonal peak but electrical energy output continues to increase slightly . . . steel also holds its own but commodity price indexes fade and the security markets stall . . . bank reserves pile up and must break out into business channels eventually.

Hunger army marches on London . . . presents million-name petition to House of Commons . . . collides with police and starts home . . . French administration faces deficit . . . also payment on debt to U. S. . . . proposes new army plan which arouses negative enthusiasm from French officers . . . Commerce minister announces abandonment of quota system of import limitation . . . will resort to tariffs . . . good news for American exporters . . . Hoover directs Tariff Commission to investigate competition from countries with depreciated currencies . . . German supreme court reinstates Prussian cabinet . . . proves it is not scared by sabre-rattling . . . Mussolini announces he is good for thirty years more . . . frees political prisoners to prove it.

U. S. Steel votes preferred dividend . . . General Motors follows suit on common . . . both largely out of comfortable surpluses . . . Taylor luncheon to railroad presidents and subsequent drop of $3 from ten-year $43 price per ton on steel rails evidently encouraging . . . Heads of rail unions to meet early in December to discuss wage situation . . . Investment bankers bid for beer tax . . . see possible revenue of $750,000,000 . . . National Credit Corp. repays 10 per cent to contributors . . . only 10 per cent now outstanding . . . Federal Reserve Board reports encouraging business increase in September . . . National Industrial Conference Board statisticians find upturn in employment in 19 out of 25 industries.

Normandie, French super-liner launched . . . Shipping Board contracts with Boston Iron & Metal Co. of Baltimore to scrap 124 old ships . . . means work for 600 men for three years . . . Hoover threatens naval building program if disarmament conference fails . . . Frisco in receivership, second since 1916 . . . New York Central work loan granted by R.F.C. . . . will provide 1,500 men with work on car and locomotive repairs for eight months . . . Reading buying motorized passenger coaches, rubber-tired rail car, ten locomotives . . . some already delivered . . . Superior Charcoal Iron Co. reports October shipments largest this year, hopes for further improvement in November . . . Republic Steel announces plan by which every employee gets at least $20 per month . . . Bethlehem board votes to take over Seneca Iron & Steel of Blasdell, N. Y. . . . Railroads report better earnings in September . . . Atterbury tells of spread-work system on P.R.R. by which each man will work enough days to earn a specified minimum and then lay off while the next man takes his turn.

Michigan Tool Co. working double shifts with 20 per cent increase in force . . . Roots-Connersville-Wilbraham Co. maker of pumps and blowers reports encouraging gains in orders . . . Spread between average high and low limits of radio set prices narrows . . . $147 to $52 at Chicago show . . . trade looks for better business, stocks unseasonably low . . . 25 new motor bus models have been introduced this year says *Bus Transportation* . . . Hudson Coal Co. establishes service department to instruct retail dealers in the selling of automatic stokers . . . our dealer apparently has not heard of it . . . Chemical Exposition postponed until 1933 . . . Index of chemical prices compiled by *Chemical and Metallurgical Engineering* rises fractionally from 84.56 to 84.63 . . . Significant of the times and evidence of a broadening viewpoint is the change of name of the American Electric Railway Association to the American Transit Association . . . *Power* describes a German boiler that revolves at the same speed as the turbine for which it generates steam . . . *Metal and Mineral Markets* says that buying interest in major non-ferrous metals appears to be slowly reviving . . . combined tonnage sold last week largest since early October . . . price recessions held an important reason . . . *Engineering News-Record* reports unseasonal October rise in heavy construction . . . cost index drops from 159.16 in October to 158.20 in November . . . volume index rises from 124 in September to 137 in October.

Elaborate Program Planned by A.S.M.E.

Judging from the extensive plans already made, the A.S.M.E. annual meeting in New York City, December 5-9, will set a new mark in technical progress. In addition to the technical sessions papers on management and economics occupy an important place on the society's program. Reports will be made by the various divisional committees.

Among the many papers to be presented those of particular interest to manufacturers in the field of metal-working are:

Applied Mechanics

Theories of Strength, A. Nadai
Working Stresses for Columns and Thin-Walled Structures, S. Timoshenko
Stress Concentration in Fatigue of Metals, R. E. Peterson
Fatigue of Metals—Its Nature and Significance, H. F. Moore
Application of Creep Tests, G. H. MacCollough
Factors Affecting Choice of Working Stresses for High Temperature Service, P. G. McVetty
Metals at High Temperature—Test Procedure and Analysis of Test Data, Ernest L. Robinson
Concerning Notched Bar Tests, Max Moser
Allowable Working Stress Under Impact, N. N. Davidenkoff
Suggestions on Choice of Working Stresses, C. R. Soderberg

Iron and Steel

The Rolling and Extension of Aluminum and Its Alloys, R. L. Streeter
Carburizing With Butane Gas, C. W. Spicer

Machine Shop Practice

Effect of Lathe Cutting Conditions on the Hardness of Carbon and Alloy Steels, T. G. Digges
What Can Be Accomplished with Modern Machine Tools and Cemented-Carbide Cutting Tools, A. A. Merry
Grinding Cemented Tungsten and Tantalum Carbide Tipped Tools Efficiently and Economically, J. M. Highducheck
Special Steel for Castings, R. A. Ball
Malleable Iron as a Component Part of Machines and Structures, E. Touceda

Management

Surpluses—Their Distribution
Long-Time Planning—For Individual Concerns
Trade Associations—Their Service
The Economic Characteristics of the Manufacturing Industries, Harold V. Coes
Management Essentials for Recovery, Carle M. Bigelow
Ten Years' Progress in Management, L. P. Alford

Application of Kmh Method of Analyzing Manufacturing Operations, L. P. Alford and J. E. Hannum

Education and Training

The Engineer's Interest in Foreman Training, Edward S. Cowdrick
Fundamentals of Training, G. Guy Via.
Adult Technical Education, Ovid W. Eshbach.

Metal-Cutting Data

At a meeting on Oct. 14 at the A.S.M.E. headquarters in New York a plan was formulated to compile a series of handbooks that will make available authoritative data with respect to feeds and speeds at which machines should be operated. The principles advanced by Frederick W. Taylor and Carl Barth are to be the basis for these handbooks.

King Hathaway, consulting management engineer, has been appointed chairman of the sub-committee which will direct this work. Other active members are: L. P. Alford, F. H. Colvin, J. C. Carlin, R. C. Deale, R. E. Flanders, W. W. Nichols, G. E. Schultz and R. T. Kent. The following have agreed to act in an advisory capacity: K. H. Condit, M. L. Cooke, C. N. Lauer, Admiral S. M. Robinson, F. I. Miller, Erik Oberg, C. M. Schwab and W. A. Viall.

A.M.A. Industrial Marketing Conference

C. J. Stillwell, vice-president of the industrial marketing division of the American Management Association and vice-president, The Warner & Swasey Co., announced that the annual conference of this division will be held in Pittsburgh, December 5 and 6. At this time the following papers will be presented:

C. J. Stillwell
Presides at A.M.A. Conference

How to Make Industrial Sales Now, Herbert P. Bailey, president, The Rotor Air Tool Co.

Maintaining Sales Organization Against the Time of Business Revival, Frederick B. Heitkamp, general sales manager, Cincinnati Milling Machine and Cincinnati Grinders Incorporated.

Program of Rehabilitation and Modernization and the Opportunities it Affords for Industrial Salesmen.

Applying the National Credit Expansion Program to Industrial Salesmen, Louis B. Williams, vice-chairman,

• INDUSTRIAL REVIEW •

Analysis of reports from leading machinery centers indicates that favorable news predominates over the gloomy variety. The political campaign has probably dampened enthusiasm lately but business has increased in spite of it. November opens with the promise of fair machinery business in most centers.

From Boston comes word that there is no noticeable change since our last report. New York, on the other hand, tells of orders booked during the last week of October that made that month the second best of the year for at least one machinery house. Philadelphia says that the last 10 days have been exceptionally quiet but reports improvement in the shops of Waynesboro, Pa.

Pittsburgh seems to be marking time, although an occasional old inquiry comes to life. Follansbee Brothers have ordered a $300,000 38-in. "Steckel" mill. Our most conservative Cleveland correspondent says that October there was better than September and that a gradual pick-up is anticipated this month. Die shops and tool companies in Detroit, also tool divisions of automobile plants are busy, and designing engineers are working overtime in some companies. Inquiries are better and the supply business is looking up, but few orders for new machinery have actually been placed. Rumors of engineering developments at Ford are interesting; something really new is apparently on the way.

Cincinnati's Rehabilitation Committee, headed by F. A. Geier, reports more pledges, and for larger amounts, than have come from the larger cities in the district. Nothing much in the way of machinery orders has come through yet. Cheap second-hand machinery has been moving, and metal trades employment has increased slightly. Nothing but used machinery is moving in the Indianapolis territory, even inquiries are scarce. In St. Louis, on the other hand, there is an improved tone. Machinery salesmen's reports indicate an upward trend. Chicago, after its flurry of activity three weeks ago, has apparently settled down to wait and see. In Milwaukee employment is up somewhat and several plants making screw machine products and small woodworking machinery are going well.

Federal Reserve Bank, Fourth District.

Industrial Sales Pricing Policies, H. S. BEAL, assistant general manager, Jones & Lamson Co.

The Trend Toward Expansion of Free Service.

A.F.A. 1933 Convention in Chicago

The 1933 annual convention and exposition of the American Foundrymen's Association will be held in Chicago the week of June 19 at the Stevens Hotel. Since the annual meeting and exhibit of the American Society for Testing Materials will be held the following week, that of June 26, it has been possible to arrange two symposiums, one on methods of testing and the other on gray cast iron. The former will be held in conjunction with the A.F.A. convention the latter part of the week, and the latter symposium during the early part of the week of the A.S.T.M. meeting. The meeting of both societies will be held shortly after the opening of the Century of Progress at Chicago.

Class I Railroad Earnings

For the month of September, Class I railroads earned a net of $49,646,869 which is equivalent to a return of 1.59 per cent on property and equipment according to the Bureau of Railway Economics. For the first nine months of 1932, the net operating income was $202,456,126 or 1.04 per cent on the investment.

These figures compare with net earnings of $55,428,260 or 1.77 per cent return for the same month in 1931 and $409,337,148 or 2.09 per cent for the first nine months of last year.

It is interesting to note that the September decline in earnings was only 9.7 per cent although the gross operating revenues fell off 22.2 per cent. This was possible because of a reduction of 26.7 per cent in operating expenses.

R.F.C. Grants N.Y. Central Loan

An application for a loan of $2,500,000 by the New York Central R.R. has been granted by the Reconstruction Finance Corporation. This sum will be used in the repair of the road's rolling stock and the work done in the shops of three states, New York, Pennsylvania and Indiana. Work for 1,500 men for eight months is provided.

Repairs to 10,000 steel box cars at an estimated cost of $150 a car and 3,000 automobile box cars at an average estimated cost of $300 a car will be undertaken with the funds made available. The work includes running gear, floors, lining and painting. For the automobile cars new roofs and draft gears are contemplated.

To give the railroad some discretion in these expenditures the application included a request to modify these repairs if traffic conditions make it advisable.

One alternative would be to reduce the number of box cars from 10,000 to 7,500, to eliminate the automobile cars and to substitute 4,000 hopper and 1,000 stock cars. Another alternative is to substitute passenger and freight locomotives for the hopper cars at an estimated expenditure of $9,000 each.

Engineers Aid R.F.C.

In an effort to speed the work of the Reconstruction Finance Corporation in granting self-liquidating loans to industry, the American Engineering Council is organizing the engineering profession to cooperate in this move. Following the appointment of 37 engineers as members of the advisory committees of the R.F.C. loan agencies, it is believed that the task of the Engineers' Advisory Board of the corporation at Washington to which the loans are submitted for final approval will be simplified.

Inadequate engineering data accompanying the loan applications causes much of the difficulty encountered by the board. Many applications are insufficiently descriptive of the projects proposed and lack essential detailed information, delaying decisions by the board until the gaps in evidence have been filled; others are alien to the purposes of the emergency act which requires that self-liquidating enterprises involve construction and the employment of men and materials.

Over a billion dollars in loans have been requested from the R.F.C. for the proposed projects. Class I applications, which are final and supported by complete data, account for $135,796,653 of this and cover 64 projects. Broken down as to type of construction these requests cover: $3,309,120 for the construction of thirty water-supply systems; $34,725,533 for eleven bridge projects; $31,963,000 for five irrigation systems; $6,859,000 for five power plants; $36,580,000 for three sewer systems; $350,000 for two terminals; $675,000 for two docks; $5,695,000 for three housing projects; $1,500,000 for the construction of markets; $4,100,000 for the construction of an airport; and $40,000 to build a ferry.

Class II applications include those which are incomplete and informal and cover 42 projects aggregating $189,051,520. Class III applications which are informal and accompanied by little or no data total 87 and involve $385,522,257. Other applications bring the total of loans requested to well over $1,000,000,000.

Engineers point out that the R.F.C. is facing the collosal task of building in a few months a financial enterprise comparable in magnitude with the whole field of investment banking which required a century to develop.

In this connection the R.F.C. directors have restated the policy controlling the granting of loans. These are: first, that the loan be secured properly and be truly self-liquidating; second, that it will put men to work. In the approval of loans which have already been granted the R.F.C. has been guided by these major considerations rather than by the protests against government competition. But these protests, legal requirements of states and municipalities and often the lack of needed legislation have served to delay the actual advance of a single dollar on 24 approved projects amounting to over $134,000,000.

Plant Rehabilitation to be Dramatized

In conjunction with the annual convention of the International Acetylene Association, to be held in Philadelphia, November 16-18, an industrial drama in three acts will be presented. This will portray the technical and practical factors in plant rehabilitation under today's economic conditions.

PROF. FRANK P. MCKIBBEN, president, American Welding Society, will preside at this session. This type of meeting has been used successfully in Soviet Russia in support of major industrial projects.

Industrial Films to Be Made by Hollywood Company

Since 1925 the Dunning Process Company, Hollywood, Calif., has supplied composite photography to major picture producers, and also has done work for industrial concerns, such as dramatizing the activities of the California Packing Corporation. Now the company is branching out into the field of industrial films. Motion pictures in color and with sound can be produced in 35 and 16 mm.

widths. Distribution for clients' film is being arranged for in 15 key cities. A small service charge to the client and gratis lending of the film to the user will accompany distribution of the 16 mm. film.

A.B.P. Awards

American Machinist received honorable mention in the awards recently announced by the Associated Business Papers, Inc., for excellence in editorial work. This mention was given in Class I of the awards for the most outstanding editorial service to industry in recognition of *American Machinist's* "Equipment Modernization Campaign—Steps 5 and 6."

The articles published in this campaign were those in connection with the 1930 Inventory of Metal-Working Equipment and the Awards for the Most Effective Replacement Policies. The A.B.P. Medal for Class I went to *Electrical Wholesaling* for "The Jobber's Salesman Plan."

Closer Tie Between Commerce Department and Associations

To promote closer cooperation between the Department of Commerce and the trade associations, individual members of the staff of the Bureau of Foreign and Domestic Commerce are being designated to contact particular associations. It is to be the duty of the individual thus selected to keep in constant touch with the association assigned to him and be in a position at all times to supply information as to its activities.

While the personnel of the commodity division in the past have kept in close contact with the principal associations in their fields, it has been found that close relationships were being maintained with a relatively small total of the active associations.

In this way the department hopes to be able to be more helpful to the members of all trade associations. In turn the associations will furnish the department with much material that will be valuable in connection with other phases of its work.

Jackling Is Honored

DANIEL C. JACKLING, president of the Utah Copper Company and president and director of many other concerns in the mining and allied industries, is the recipient of the John Fritz gold medal for 1933. The award was made by a board of sixteen representatives of four national engineering societies for "notable industrial achievement in initiating mass production of copper from low-grade ores, through application of engineering principles."

N.M.T.B.A. Moves to Cleveland

On November 1 the National Machine Tool Builders' Association moved to 1220 Guarantee Title Bldg., Cleveland. The offices were formerly at 1415 Enquirer Bldg., Cincinnati.

Lamson to Distribute Webb Conveyor Systems

The Lamson Company, Syracuse, N. Y., and the Jervis B. Webb Company, Detroit, have arranged for future distribution of Webb overhead chain conveyor systems through and by the Lamson Company. The latter manufactures automatic conveyors for various industries and also produces pneumatic tubes. Through this distribution plan sales engineering advice and service facilities on the two lines will be available for the entire continent.

Exports of Machinery During September, 1932

	Sept., 1932	Aug., 1932	Sept., 1931
Electrical machinery	$3,032,824	$2,423,856	$6,703,717
Power-generating machinery (except electric and automotive)	249,766	299,832	1,844,566
Construction machinery	180,581	306,686	1,355,601
Mining, well and pumping equipment	780,257	797,863	2,273,626
Power-driven, metal-working machinery	1,074,471	992,903	5,055,073
Other metal-working machinery	87,714	139,972	473,205
Textile machinery	257,389	282,752	496,900

Exports of Metal-Working Machinery During September, 1932

	Sept., 1932	Aug., 1932	Sept., 1931
Engine lathes	$82,273	$46,741	$60,490
Turret lathes	3,597	.....	13,684
Other lathes	44,651	19,136	129,349
Vertical boring mills and chucking machines	11,223	16,096	175,273
Thread cutting, automatic screw machines	22,495	10,880	31,440
Knee and column type milling machines	29,413	47,436	61,041
Other milling machines	55,861	59,437	189,172
Gear cutting machines	103,309	28,995	263,490
Vertical drilling machines	2,777	1,546	60,652
Radial drilling machines	.....	.....	11,892
Other drilling machines	39,281	1,466	238,578
Planers and shapers	2,086	4,222	82,824
Surface grinding machines	23,634	9,256	30,971
External cylindrical grinding machines	26,439	37,745	133,330
Internal grinding machines	88,108	17,236	129,667
Tool grinding, cutter grinding and universal grinding machines	16,247	18,545	39,213
Other metal grinding machines	81,168	17,571	207,462
Sheet and plate metal working machines	194,322	495,438	1,803,802
Forging machinery	27,634	7,881	701,319
Rolling mill machinery	19,633	1,197	65,881
Foundry and molding equipment	28,481	18,600	138,811
Other power-driven metal-working machinery and parts	171,839	133,479	467,222
Related Exports			
Pneumatic portable tools	29,639	17,939	68,418
Machine-operated pipe and thread, cutters, stocks, dies, taps and other machine-operated cutting tools	15,047	89,755	189,190
Other metal-working machine tools	8,005	12,474	200,061

•BUSINESS ITEMS•

Production was started the first week of November at the plant of the old Warren Tool & Forge Co., Warren, Pa. Now organized as the Warren Tool Corp., the plant will make tools for railroads.

The Oster Mfg. Co. and the Williams Tool Corp., Cleveland, have appointed the ParKett Machinery Division of Austin-Hastings Co., Inc., Cambridge, Mass., as New England distributor of the Oster and Williams lines of pipe threading equipment.

Amerika-Interessen, Inc., was organized recently (*AM*—Vol. 76, p. 1036e) to promote the exchange of patents and manufacturing processes between the United States and Germany. BOTHO LILIENTHAL is president of the corporation. New York offices are in the Chrysler Bldg.

Manager's headquarters of the plastics department of the General Electric Co. have been moved from Meriden, Conn., to the Pittsfield, Mass., works. Hot-molded products will be made at Pittsfield and cold-molded products at Meriden. Sales offices of the department are at Lynn, Mass.

The Roller-Smith Co., New York, N. Y., made appointments as follows: Burkholder & Kelley, 105 Cortleigh Blvd., Toronto, Ontario, Canada, as its district sales agent for the Dominion of Canada, and MARK G. MUELLER, 1700 16th St., Denver, Colo., as dis-

trict sales agent for the States of Colorado and New Mexico and for the western part of Kansas.

Articles of incorporation have been filed in Indianapolis by the Acme Machine Products Co., Inc., Terre Haute, Ind., formed to manufacture a line of machine tools and similar equipment. The corporation has an initial capital stock of 16,158 shares of preferred stock having a declared par value of $10 each and the same number of shares of common stock having no declared par value. The first board of directors is composed of JOSEPH H. BRODERICK, EARL A. MUNGER and FRANK B. BERNARD.

The Keystone Lubricating Company's plant at Philadelphia burned on Oct. 3, but the offices of the company are temporarily at the Steel Heddle Mfg. Co., 21st and Allegheny Ave. The plant will be rebuilt very soon. Meanwhile supplies are available through jobbers.

The Lincoln Electric Co., Cleveland, Ohio, has appointed FRED C. ARCHER as manager of the Philadelphia district, the office being located at 401 N. Broad St.

Farrell-Birmingham Co., Buffalo, N.Y., has appointed E. J. VON DER HEIDE sales representative to handle Farrell-Sykes gears, gear units and gear generators in the middle west territory. Mr. von der Heide's headquarters are at 824 Miami Savings Building, Dayton, Ohio.

• PERSONALS •

DR. WILLIS RODNEY WHITNEY, who organized the laboratory of the General Electric Co. in 1900, retired on Nov. 1, and was succeeded by DR. WILLIAM DAVID COOLIDGE, one of the two associate directors. Dr. Whitney will continue as vice-president in charge of research.

THOMAS I. S. BOAK, who was formerly works manager at Goulds Pumps, Inc., Seneca Falls, N. Y., has become identified with the Western Cartridge Co., at the New Haven plant.

ALEXANDER T. FILIPKIN, a representative of the Cheliabinsk tractor plant of the U.S.S.R., arrived recently in the United States to study lathes and other metal-working machinery.

A. L. FREEDLANDER, vice-president and factory manager of The Dayton Rubber Mfg. Co., Dayton, Ohio, was a passenger on the Graf Zeppelin from South America to Germany on its fourth trip, Oct. 29. Mr. Freedlander had been in South America, and took the Graf to contact automotive engineers in Europe.

STANLEY C. HOPE has been elected president and general manager of the Gilbert & Barker Mfg. Co., Springfield, Mass., succeeding CHARLES C. RAMSDELL. Mr. Hope was formerly vice-president and general manager. P. H. BILLS, treasurer, has also been elected vice-president.

COL. GEORGE M. MORROW, JR., has been elected president of the Goslin-Birmingham Mfg. Co., Inc., Birmingham, Ala., to succeed the late JULIUS GOSLIN. Col. Morrow was vice-president for the past several years in charge of the two plants at Birmingham.

WILLIAM G. NEWTON, formerly president of the Newton Die-Casting Corp., New Haven, Conn., has opened an office at 151 Court St., New Haven, as a consulting engineer specializing in die-castings and die-casting equipment.

CHAUNCY P. ROSS, assistant general manager; J. E. DELONG, sales manager; J. B. FISHER, chief engineer, and ANDREW S. CRONK, purchasing manager, Waukesha Motors Co., Waukesha, Wis., have been elected directors of the company so that a general manager's committee may operate in the event of absence, illness or death of the president.

W. S. SHIPLEY, president of the York Ice Machinery Corp., was elected president of the Refrigerating Machinery Association at the society's 19th annual meeting, Oct. 20-22, in Detroit.

L. C. STOWELL, president of the Dictaphone Corp., was elected president of the Equipment Manufacturers' Institute at the annual meeting Oct. 14.

• OBITUARIES •

THOMAS F. COADY, 74, superintendent of the Kennedy Foundry Co., Baltimore, died Oct. 24.

JOHN C. HOLLANDS, 70, for 48 years identified in various executive capacities with the Griswold Mfg. Co., manufacturer of aluminum equipment, Erie, Pa., died recently.

HENRY J. KARGES, 66, head of the Evansville Stove Works, Evansville, Ind., died recently. Mr. Karges organized the stove company 48 years ago.

WILLIAM LAIDLAW, 45, president of William Laidlaw, Inc., Belmont, N. Y., died Oct. 24. He developed a metal-cutting bandsaw and an abrasive-wheel cut-off machine.

WILLIAM E. OSWALD, a superintendent of the Elizabethport repair shops, Central Railroad of New Jersey, died Oct. 20. He was with the railroad for 31 years.

ARTEMUS W. PICKARD, 62, vice-president of the Bass Foundry & Machine Co., Fort Wayne, Ind., died recently.

JOHN ROCKE, 62, founder of the Meadows Mfg. Co., Bloomington, Ill., died Oct. 18. He resigned the chairmanship of the company in 1929. Mr. Rocke had manufactured both grain elevators and washing machines.

S. COLLIER SMITH, president and general manager of the Quickwork Co., St. Marys, Ohio, died recently.

• MEETINGS •

AMERICAN ENGINEERING COUNCIL. Annual meeting. January 15, 1933. Washington Hotel, Washington, D. C. L. W. WALLACE, secretary, 744 Jackson Place, Washington, D. C.

AMERICAN MANAGEMENT ASSOCIATION. Annual conference of the industrial marketing division. December 5-6. Hotel William Penn, Pittsburgh. KENNETH B. ANDERSEN, secretary, 20 Vesey St., New York.

SOCIETY OF AUTOMOTIVE ENGINEERS. Annual meeting. January 23-26. Book-Cadillac Hotel, Detroit. JOHN A. C. WARNER, secretary, 29 West 39th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting. December 5-9. New York. CALVIN W. RICE, secretary, 29 West 39th St., New York.

GRAY IRON INSTITUTE. General meeting of gray-iron executives. Thursday afternoon, November 17. Waldorf-Astoria Hotel, New York. Gray Iron Institute, Cleveland.

INTERNATIONAL ACETYLENE ASSOCIATION. Annual convention. November 16-17-18. Penn Athletic Club, Philadelphia. T. C. FETHERSTON, secretary, 30 East 42nd St., New York.

MALLEABLE IRON RESEARCH INSTITUTE. Annual meeting. December 14. Cleveland. ROBERT E. BELT, secretary, 1820 Union Trust Bldg., Cleveland.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING. December 5-10. Grand Central Palace, New York.

NATIONAL FOUNDERS ASSOCIATION. Thirty-sixth annual meeting. November 16-17. Waldorf-Astoria Hotel, New York. J. M. TAYLOR, secretary, 29 South La Salle St., Chicago.

THE ROUND TABLE

Borrowing from the Bank

"Say, Ed, what is the best time to interview a banker? What does the book on psychology say about it?"

"The book I read said not to interview a banker at any time if it can possibly be avoided. Why?"

"I'm going down to have an interview with Caleb Sprague of the First National, and I was wondering whether it would be best to see him before or after lunch."

"Don't see him at all, if you take my advice. Those guys are not subject to psychological rules. They're always hard boiled. Why do you want to see Sprague, anyway?"

"What do people usually see bankers for? I want to get a loan."

"Oh, you want to work for Sprague, eh?"

"No. I don't want to and don't intend to work for any bank. That's the reason I'm going to see Sprague now—while we've got a good balance."

"For the love of Pete. If you've got a good balance, why do you want a loan?"

"My dear Ed, didn't you ever observe that the best time to borrow money was when you didn't need it?"

"It often seems that way, but I never tried it on a banker. It costs interest to borrow from those guys—usually paid in advance, too."

"It's the best time to borrow from banks, too, Ed. As we don't really need the money, I can be much more independent with Sprague than I could if the continued existence of the firm depended upon my getting a loan. That will create a better impression on Sprague. I'll tell him frankly that I'm testing my credit at his bank and that I want to borrow $1,000, at bank rates for six months with the possibility of renewal and with only our signatures for security."

"Yeah. I see you getting it. Lots of others have walked into a bank all puffed up with the idea of bluffing a banker, but they don't come out quite as jaunty as they went in. Bankers can only be bluffed on a large scale. You go fooling around them when you don't have to, and they'll own your business all the sooner. What'll you do if Sprague says no?"

"If he says no, I'll tell him that if his confidence in our firm is not equal to a loan of $1,000, we're doing business at the wrong bank. I'll withdraw our account then and there and take it over to the Trust Company. That's the reason, Ed, why it's a good idea to borrow when you have a good balance. In fact, Mason and I have tried to make the balance as big as possible just to impress Sprague. I'll bet you our next lunch that I get the loan."

"Maybe you will, but the result will be the same. The time will come when the bank balance won't be as large—when an extension will be necessary. Sprague will know that before you do. And then what a difference there'll be! If I had a shop, no banker would ever be in a position to tell me who to let out in order to make room for a representative of the bank. I'd go out of business or remain in a small shop all my life before I'd borrow from the bank, because I know that in the end they'd own me."

"That's the reason why I'm establishing credit now, Ed, while I'm able to be independent. The bank lends on character in the final analysis and I'm going to borrow when I don't have to and pay back promptly. When we really need it I can get a loan without trouble."

"What you're really doing, Al, is working the old game of borrow and pay back promptly until you can borrow enough to make it worth while not to pay back."

"Sure. But with the difference that we're honest and will always pay back."

Is Al's plan good business or just a bluff? Should a small business man keep entirely clear of banks?

Discussion

Branching Out

Where business, in single product industries, tapers off for protracted periods, because of seasonal trends, the only feasible thing to do is add lines of product, in order to pay the overhead and keep the working force intact.

In Al's and Mason's case, seasonal trend is not a contributing factor, but the general economic condition is. If Al and Mason do not consider the addition of lines of product practicable in normal times, it is certainly questionable whether the addition of new products as an expedient during an economic depression is practicable.

If Mason's valve possesses merit, he should sell his idea to a reputable valve manufacturer, who can merchandise it with a minimum of sales expense—his sales force being already established. The money secured from the sale of the valve project could well be spent in financing Mason's sales activities, which should be confined to soliciting repair work in the compressor field.

The amount of repair work secured would probably take care of idle plant and equipment, and Mason's activities would give him a true perspective of future sales possibilities. His entree to the plants of prospective new equipment purchasers would enable him to talk

figures and actualities and would give him a decided advantage over his competitors. —IRA S. WILLIAMS.

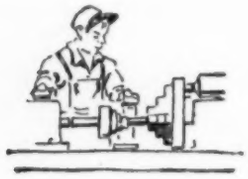
Slightly Worn

Dear Al:

In the history of the development and marketing of your compressor, the ownership or non-ownership of a boring mill has nothing to do with the case. The inherent integrity of the design in detail and in execution has everything to do with it.

What if the casing was not faced parallel and square on an experimental job? True, it should be right, but let us consider first how the brute acted when called upon to work.

Part load performance was O.K., and when used as a vacuum pump, performance was satisfactory. How did it act on full load as a compressor? Did it start out well and later fall by the wayside? If so, look out for our old friend distortion under load or thermal stresses. Cut a few inspection holes in the principal parts, such as may be plugged, and assure yourself that the castings are as they should be. If they are not, it is your hard luck for not finding this out before, and you had better junk



those parts, if the design means anything at all. If they are O.K., plug the holes and treat the thing as a repair job. Depending upon the magnitude of the main frame error, either scrape the job back to shape or reface and fit a "dutchman" on the bad end or ends, repair your rotor to fit, and retest. If it still acts up, drill a few holes in the suspected parts, plug with closely temperature spaced fusible alloy plugs, measure the temperatures at which you are operating, and you will most likely find in a number of instances that these are way above what you anticipated, and that your cooling system needs a definite revamping.

Never forget that machines under load operate with deflected parts, the deflections coming from either external or internal forces, and that the "drawing board relation" of the various parts exists on the drawing board only.

The thing to do now is to prove the integrity of the design. You have questioned already integrity of execution and found it lacking. Fix its lack with means at hand, prove or develop the integrity of the design, and then, lastly, think about your boring mill.

Don't be too discouraged if you find you have to make some alterations, but be sure by repeated check that each step you take is logical and dictated by previous measurement and not by hunch only. —R. V. HUTCHINSON,
Production Engineer,
General Aviation Mfg. Corporation.

There are a dozen reasons, at least, why a man should not buy a second-hand machine. There is one reason why he should, and it is synonymous with the circumstances in which Al now finds himself. When the price of a new piece of equipment is greater than the entire capital, both on hand and in sight, there is nothing to do but to do the best one can. And right there the rebuilt machine comes in for consideration. Sometimes a rebuilt machine means a good one, and sometimes it means little or nothing. It depends upon who has done the rebuilding. If it has been done by an established and reputable machine builder, good. If it has been done by the firm who built the machine in the first place, better. With such a machine, one may get along well for a few years.

Al well may fear the formation of the habit he mentions, however, or he may well fear that Mason will want to do the same thing over and over again. And Al himself, when he says that the machine purchased must last a lifetime, is on dangerous ground. After all, the second-hand machine ten years of age is as good a bet as the one that has set in your own shop for ten years, except for the fact that you will be a little better acquainted with the faults of the latter.

As I see it, here is the proper policy for Al and Mason to follow. First make absolutely sure that they cannot swing the proposition of a new boring mill. If they cannot, then look around for a rebuilt one. Finally, if it is absolutely necessary, let them buy a second-hand machine which has not been rebuilt, but let them bend every effort toward the glad day when they can cart it to the dump, and install one that will give them no trouble. —JOHN E. HYLER.

In Our Own Shop or Outside?

Because of a change of method of mailing *The Literary Digest* from hand mailing to machine mailing, we found our addressing machines in the office were not able to produce the exact work demanded by the new system. To have the necessary work done "outside" meant an outlay of $10,000. After a careful study of the work to be done I decided to establish my own machine shop to do it. We bought new equipment, lathe, miller and drill press with the necessary other equipment purchased as we went along. We have completed the original job at half the cost "to do it outside" and now have a fine machine shop which cost us nothing, employing three first-class machinists and two helpers, doing all our work of overhauling, repairing and experimental work. —JOHN LANGENHOF,
Funk & Wagnalls Company.

Tools a-la-Carte

The temptation to over-rate the capabilities of one's organization would seem to have led Williams astray in this particular case. Unless he is fortunate in possessing a handpicked aggregation of men and machines, his savings in eliminating the toolroom are likely to be conspicuous by their absence. While it is admitted that the standards of equipment and shop personnel have risen in past years, there is still a scarcity of really dependable machinists who can be relied upon to produce accurate work in a minimum of time. Again, there will always be jobs calling for the *n*th degree of precision which is the particular province of the skilled toolmaker. Yet most of us are agreed upon one thing. There must be a grading of toolroom work and machinery so that the time of a highly skilled man shall not be wasted in producing work that can be produced by a machine operator.

An era of specialization which has produced sweeping changes in manufacturing cannot be allowed to stop at the door of the toolroom.

—ROBERT S. ALEXANDER.

Shall the Customer Furnish Gages?

Al has found out that the trouble in his compressor came from a poorly done job on the frame of the machine. This is probably the result of one of those verbal agreements where the customer tells the jobber that the dimensions on a certain part are not so fussy and that they would fit the other corresponding part to it. Then the jobber is not so careful as to the methods he uses to make the part. Something slips, the job is not quite right and the argument starts.

Al and Mason have an order for four more machines and probably will get more in the near future so it would pay to make gages for the most important dimensions. Tucker is justified in something more tangible to work by, and Al ought to furnish it. —A. BEUSCH.

American Machinist
Reference Book Sheet

Plating Rolled Zinc and Zinc Die Castings

1. BUFFING
Buff on cloth wheel, using free cutting tripoli.
Color on cloth wheel using soft, dry white compound.
Use peripheral speed of 5000-6000 feet per minute.

Precautions
- Avoid grinding on die castings as outer skin presents densest surface for plating.

2. CLEANING
Use trisodium phosphate solution, boiling hot as electro cleaner (6 oz. per gal.). Make article cathode. Use sufficient current to cause gassing. For recessed articles, a dip in Xylene prior to this cleaner is effective in removing grease.

- Thoroughness in this step will avoid peeling and blistering in nickel.
- Do not add sodium hydroxide or sodium cyanide to cleaning solution.

3. RINSE
Use alternate hot and running cold water.

4. ACID DIP
Use 1% Hydrofluoric acid or 5-10% Hydrochloric acid cold dip. Dip one minute or until surface is slightly etched.

- The acid dip will compensate for minor faults in cleaning and will also remove any zinc salts formed by the cleaning solution.
- Etched surfaces improve the adherence of plated coatings.
- Avoid discoloration.

5. RINSE
Use running cold water rinse.

- Make this rinse thorough as carry over of Hydrofluoric acid to nickel bath produces an undesirable type of anode corrosion.

6. NICKEL PLATING SOLUTIONS
All Amounts in Ounces per Gallon

	2 Oz. Bath (Regular Bath)	3 Oz. Bath (Rapid Bath)
Single Nickel Salts	10	15-18
Anhydrous Sodium Sulphate	10-15	45
Ammonium Chloride	2-3	3
Boric Acid	2	2
pH Range—Colorimetric	5.8-6.2	5.4-5.9
Temperature	Room	24-30° C.
Plating range—amps./sq. ft.	12-20	24-36

- Apply a nickel coating at least .0003" thick.
- If peeling occurs look to your cleaning.
- Apply a substantial coating of nickel before plating with brass, copper, bronze, silver or gold. These coatings applied direct are readily absorbed by the zinc base.
- Check pH daily.
- Check nickel content once each week.
- Agitate cathode to prevent burning and pitting. Agitation permits use of higher current densities.
- In order to obtain deposits of reasonable thickness and corrosion resistance in recesses the use of auxiliary anodes is recommended.
- If streaking occurs, raise current density. If streaking occurs at high current density, the solution must be purified.

(See page 9—The Plating of Rolled Zinc and Zinc Base Die Castings—by The New Jersey Zinc Company.)

7. RINSE AND DRY
Use running cold water, rinse and dry thoroughly in sawdust, hot water, or whale oil soap solution.

8. COLORING
Color the primary nickel coating with dry, white nickel coloring compound on cloth wheel.

- A high lustre on the colored nickel will prove advantageous in securing a bright chromium finish.
- Avoid excessive time between coloring nickel and plating with chromium.

9. CLEAN AND RINSE
Use procedure as outlined in steps number 2 and 3.

10. CHROMIUM PLATE—SOLUTION
CrO_3 ..... 33 oz. per gallon
H_2SO_4 ..... 0.33 oz. per gallon
or
CrO_3 ..... 33 oz. per gallon
$Cr_2(SO_4)_3$ ..... 0.44 oz. per gallon
Use at temperature 45°C.
Current density—75-150 amperes per square foot.
Time—(3 to 6 minutes)
Anodes—(Lead).
Specific gravity—1.17-1.18 grams per cc.

- Scour anodes at regular intervals.
- Check specific gravity, maintain at 1.17-1.18 grams per cc.
- If temperature exceeds 45° C (113° F) higher current densities must be used for good covering and brightness.
- When plating chromium direct on zinc, with no nickel undercoat, it is advisable to plate for 20 to 25 minutes to secure a good corrosion resistant coating.

STRIPPING SOLUTIONS

NICKEL		CHROMIUM
Water	1 part	Make articles to be stripped the anode in any alkaline cleaning solution. A tank separate from the cleaning tank should be used.
Sulphuric Acid	2 parts	
Nitric Acid	1 part	
Hydrochloric Acid	1/8 part	

11. RINSE AND DRY
Use running cold water rinse and dry thoroughly as in step No. 7.

12. COLORING
Color the chromium with chromium finishing compound.

- Color with finishing compound for added lustre and to remove chromium stains.

Courtesy of the New Jersey Zinc Company

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• IDEAS FROM PRACTICAL MEN

Air Auxiliaries on a Forging Press

CHARLES F. HENRY

A heavy forging press in the forge shop of the National Supply Company, Torrance, Calif., has been increased in production by the addition of two compressed-air auxiliaries. One is an air operated piston, the other a reservoir with a pipe line running to a cylinder under the forging die.

Two punches are used in the press, these being mounted on a slide on the lower side of the ram. Movement of the slide is controlled by the air piston mentioned, and the cable that runs over the pulleys *A*, Fig. 1. The cylinder itself is seen on the ram in Fig. 2.

The smaller of the punches pierces the blank to provide for the boring and for the tapping of the taper thread. A cooling tank has been arranged behind the press so that when the large punch enters the die, as shown in Fig. 1, the piercing punch dips into the tank and has a chance to cool to some extent before it again enters the hot forging.

The air reservoir, shown on the floor in Fig. 2, is for ejecting the forging from the die. To effect this an ejector pin is put into the bottom of the die, one of these pins being seen at *B*. When the forging is completed and the ram raised, air is admitted under the ejector pin and the forging is forced out of the die. The ejector pins are easily made and are so proportioned that the available air pressure forces the work out without difficulty.

Rolling Grooves in Shells

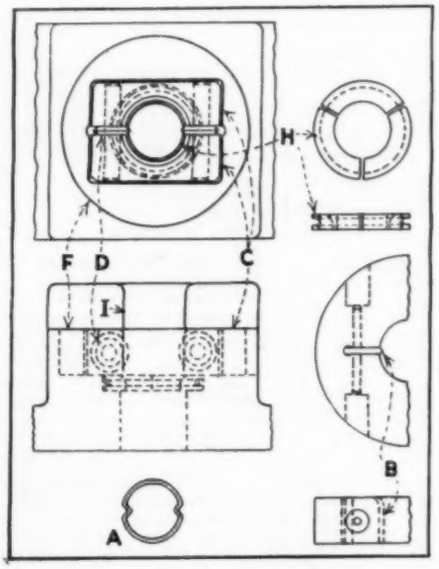
CHARLES F. KRAUT

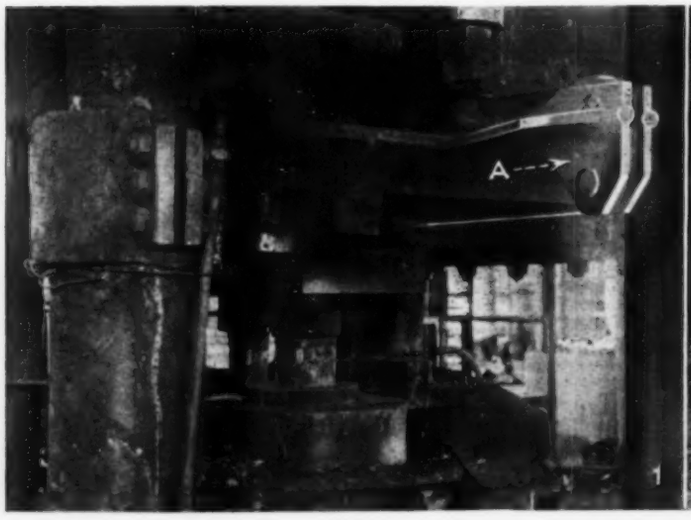
We had to make a large quantity of drawn shells having two V-shaped grooves on opposite sides, as shown at *A* in the illustration.

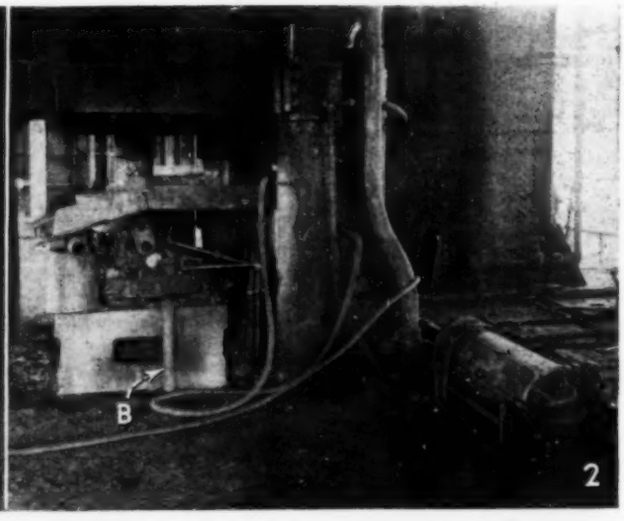
At first, the grooves were made in a die by pushing the shells past two V-shaped blades, rounded on top, as indicated at *B*, the punch having grooves to match the blades and allowing for the thickness of the metal in the shells. The friction due to pushing the shells over the blades caused the blades to wear rapidly, so that the grooves lost their size and shape. If the blades were not frequently replaced to keep the grooves to size, the shells could not be accurately assembled in the product.

We then made the die *C*, substituting V-shaped rollers *D* for the blades, the punch remaining as before. In slotting the die for the rollers, the slots were not cut quite through to the central hole, leaving thin walls. After the die was hardened and ground, these walls were cut through by an elastic abrasive wheel. Since the die was then in halves, it was necessary to hold the halves in place by the retaining ring *F*. The stripper *H* is placed in a recess in the bolster below the die. It has a bell-mounted hole and is split into three sections, the sections being held together by a music-wire spring let into a groove in the periphery. The bell-mouthed nest is doweled to the top of the bolster and is held down by screws (not shown), clamping the die and the retaining ring. It is open in front, leaving a passage for feeding the shells to the die in an upright position.

In operation, the descending punch pushes the shell through the die and between the rollers, thus rolling the grooves. As the punch continues its descent, the closed end of the shell is pushed into the bell-mouthed opening in the stripper, opening the sections against pressure of the spring and permitting the shell to pass through. After the shell has passed through the stripper, the spring closes the sections about the







punch, so that as the punch ascends the shell is stripped from it, falling through a hole in the bolster and into a container below.

These tools are applicable to blanking and drawing operations in a double-acting press. Where redrawing is not necessary, the bottom of the combination blanking and drawing die can be recessed to receive the roller die and its retaining ring. Then blanking, drawing, and grooving can be done at one stroke of the press.

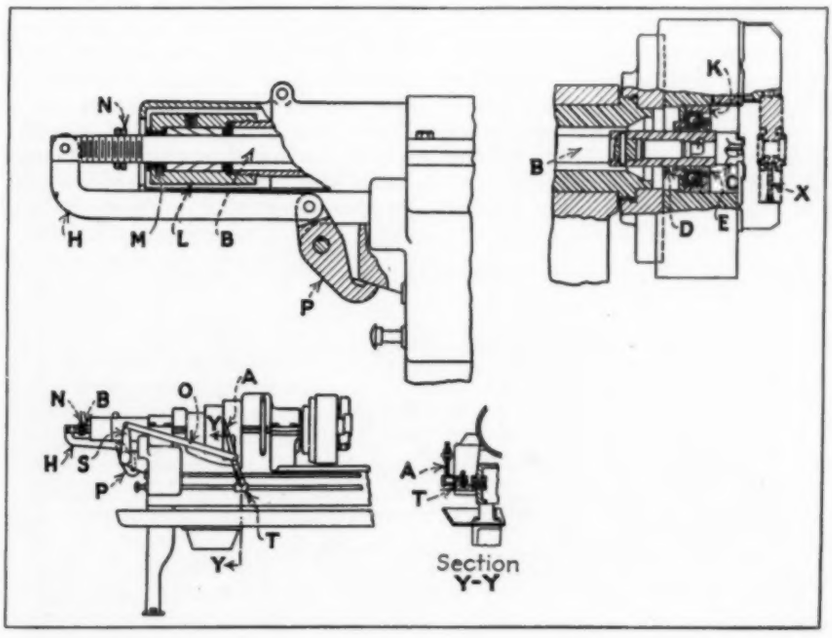
Back-Facing and Counterboring Equipment for the Turret Lathe

GEORGE L. PYRITZ

The equipment illustrated was designed for facing and counterboring the backs of the hubs of water-pump impellers in a turret lathe, the work being indicated at *X*. Its use made it possible to bore the hole and to face and counterbore both ends of the hubs at the one chucking. Incidentally, the equipment can be used on a great many jobs where small diameters are to be faced and counterbored.

In use, the lever *A* is pulled to the right, imparting motion to the bar *B* and the counterboring tool *C*, bringing the tool into contact with the work. The toolholder *D* is of hardened steel, ground, and is a sliding fit in the bushing *E*. The facing and counterboring tool *C* is necessarily a left-hand cutter and is held in the toolholder by a bayonet lock. This method of holding the cutter facilitates replacing it with other cutters to suit different jobs. The cutter is prevented from rotating by the link *H* attached to the rear end of the bar *B*. The bearing retainer *K* is pressed tightly into the chuck, which is bored to receive it.

At the rear the spindle is provided with a thread, ordinarily used for an air cylinder. A bearing retainer at *L*, provided with a roller bearing, is screwed on this end of the spindle and a bronze thrust bearing at *M* is pressed into the retainer. The nut *N* is used as a stop to regulate the depth of cut. Incidentally, the counterbore on this job was held to a limit of 0.005 in. The movement of the lever *A* is transmitted to the bar *B* through the links *O* and *H* and the arms *P* and *S*. The lever *A* is pivoted to the bracket *T* attached to the machine bed, as shown in section *Y-Y*. The arms *P* and *S* are pivoted on bosses that were originally provided for the use of collet equipment.



Drawing in a Single-Action Press—*Discussion*

E. F. TEIGH
Richmond, Surrey, England

The contribution by James R. Cornelius, under the title given above (*AM*—Vol. 76, page 834), describes a very interesting solution of the often-recurring problem of compensation for the increasing spring pressure when deep drawing is done in a single-action press. There are several devices that are intended for automatically and progressively reducing the pressure on the blank during the drawing operation, but none of them is quite so simple as the solution being discussed. While not doubting that Mr. Cornelius was able to produce the required cup by his method, one does wonder if the same method would be successful when employed upon different metals.

In drawing, it seems that the inherent strength of the material is a big factor, and it seems difficult to believe that what would be correct in the deep drawing of brass would apply equally well for steel. In connection with this, Mr. Cornelius states that the stock was 0.032 in. thick, but he gives no inkling as to the material.

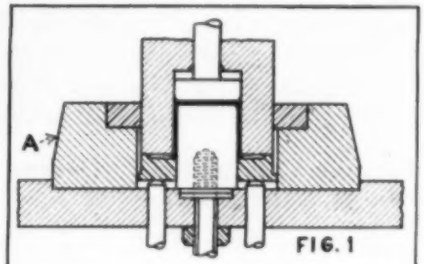


FIG. 1

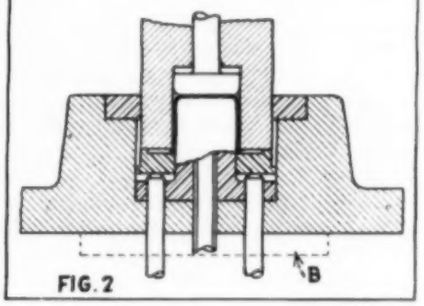


FIG. 2

While the writer has no criticism to offer concerning the method employed by Mr. Cornelius, there is one point in the construction of his tools that could possibly be improved.

Referring to Mr. Cornelius' illustration, it would appear that the center forming-block *J* is screwed into the die-block *H* from below, and furthermore, the pressure pins *K* are provided with heads for the apparent purpose of retaining them in the tool. If the press should be set at any time in such a way that the pressure ring *N* strikes the heads of the pressure pins, it would seem that the forming block would be pushed through the bolster, the threads, of course, being stripped in the process. Even if such an accident does not take place, it would still appear as if the constant pressure exerted would loosen the thread and eventually cause similar trouble.

It is suggested that a better construction would be the one shown in Fig. 1 in the accompanying illustration, in which it will be seen that the customary bolster is employed and that the die-holder *A* is let into it. Headless pressure pins are used, and the bolt holding

the forming block also anchors the pressure pad. A still better construction is shown in Fig. 2. This construction is rather more expensive than is the one in Fig. 1, since it necessitates a special casting. However, the forming block has a large base that fits down into the well in the casting, distributing the load over a greater area. The pressure pins operate through the flange of the forming block, as shown. Where more strength is required in the bolster, it can be thickened as at *B*, the added portion entering the clearance hole in the press bed.

Finning Air-Cooled Cylinders
Discussion

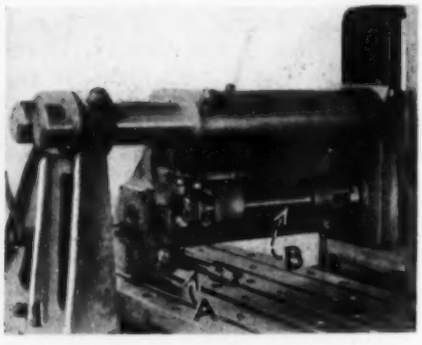
DUDLEY L. CURTIS

The method of finning air-cooled cylinders described by E. L. Marks in an article under the title given above (*AM*—Vol. 76, page 468) is without question a very efficient way to perform such work. However, like a great many jobs in which there are two or more ways of doing the work, the fins on the cylinder illustrated by Mr. Marks can be either turned or milled. The fixture and the attachment shown in the accompanying illustrations are for doing the work by milling.

In Fig. 1 is shown the milling attachment without the fixture. It consists essentially of a housing attached to the column face of the machine, and into which is built a geared drive that starts from a gear mounted on the spindle and continues through shafts and other gears to the drive shaft *A* for the fixture, lying at a right angle to the spindle. This shaft is multi-splined and slides within the sleeve by which it is driven. At its outer end is a universal joint to care for any misalignment between it and the driven shaft of the fixture due to the independent movement of the table in adjusting the work to the cutters. The overhanging weight of the unit is supported by the overarms, which in turn are supported by the usual braces.

A diagrammatic layout of the attachment and the fixture can be seen in Fig. 2. The shaft *A* is connected to the driven shaft *C* of the fixture through the universal joint. A worm mounted on this shaft drives the wormwheel *D*, which is mounted on the same shaft that carries the pinion *F*, meshing with the gear *H* on the work-spindle. The cylinder to be milled is mounted on an expanding mandrel solidly supported in bearings at both ends, and driven by a tongue engaging a slot across the end of the work-spindle. In the upper right-hand corner of the illustration is shown the relation of the gang of cutters to the work, while directly below is indicated their respective directions of revolution.

After a cylinder has been loaded in the fixture, it is fed against the cutters until the cut has reached the correct depth. When the cylinder has made a full revolution, it is moved clear of the cutters and its rotation is stopped by disengaging a clutch in the driving unit.



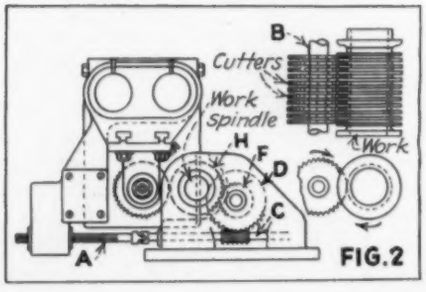


FIG.2

Fixture for Milling Face Cams

L. L. LOCKE

In the illustration is shown an automatic cam-milling fixture that can be used in a milling machine of the knee type. It consists of the base *A*, on which is mounted the dovetailed slide *B*, housing the drive for the master cam and the cam to be milled.

In use, the machine table is locked in position after the correct adjustment of the work to the cutter has been made. The driving shaft is attached to the feed shaft of the machine through the universal joint *C*. Through miter gears at *D* the drive is directed to the worm shaft *F*, the worm driving the work spindle by a wormwheel. On one end of the spindle is mounted the master cam and at the at the other end is a flange serving as a faceplate for mounting the work.

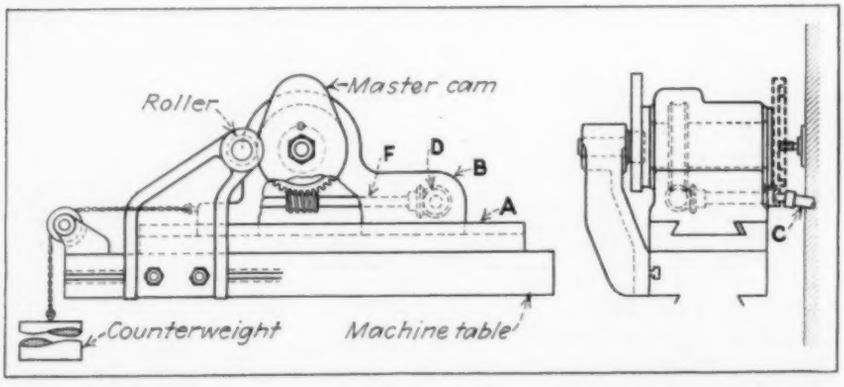
The fixed roller for the master cam runs on an anti-friction bearing and is carried by a bracket attached to the base of the fixture. Since the dovetailed slide is counterweighted, the master cam is kept in contact with the roller at all times, thus the slide travels back and forth in direct relation to the contour of the master cam, and the work is milled to the same form as it rotates and travels past the cutter. If desired, a clutch can be mounted on the drive shaft, so that the work spindle can be stopped independently of the machine. If the clutch is provided, it will be well to extend the worm shaft past the miter gears and to fit it with a crank handle for hand rotation in setting up.

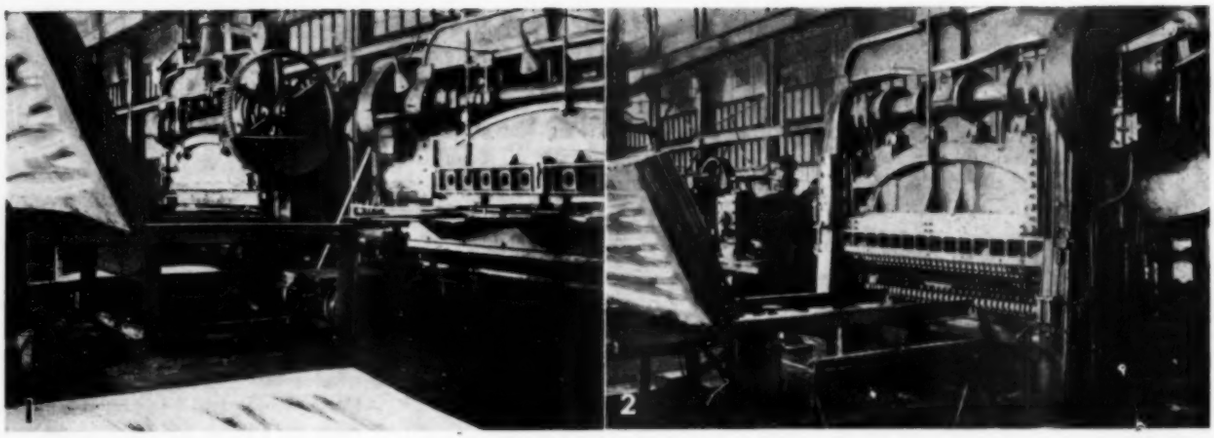
This fixture will be very useful in shops where the runs are short and where a variety of cams are to be milled. For smaller or larger master cams, the bracket carrying the cam roller is adjustable along the base.

Fixtures for Punching and Shearing Large Plates

W. J. TANGERMAN
Shop Superintendent,
Union Metal Products Co.

In punching and shearing ¼-in. and ⅜-in. corrugated plates up to about 6x8 ft., specialized fixtures become necessary. Since many shops are faced with similar problems, those illustrated here will probably be found generally applicable. The corrugated plates at the left of Fig. 1 lean upon an A-frame with an elongated base somewhat similar to that illustrated in Fig. 3, but without the counterweighted extension arms. Plates thus corrugated would normally require horizontal stacking, and some sort of hoist to pick them up individually for shearing on all four edges. By set-



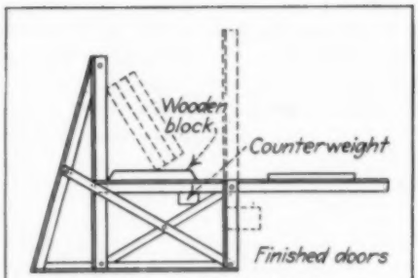


ting the stack at an angle, however, the plates may be easily pulled loose at the bottom and slid down individually by hand.

After the first edge has been sheared, the plate must be swung to get at the opposite side and both ends. This is accomplished by a little car running on rails, equipped with an 8-in. air cylinder and piston with a rotatable platform at the top. The air cylinder is remote controlled, so that the operator may raise and lower it while his helper positions the sheet. The cylinder itself is built up of 8-in. pipe and ½-in. plate and the table above the cylinder rotates on ball bearings. The car is built up of plate and channel.

Punching the holes in the plate previous to shearing permits all gaging for shearing to be done by locating taper pins in the holes in the press sub-table and in the fixture. Thus, when the ends are sheared, gaging is by four taper pins, two in the press sub-table and two on the arms of the holding fixture. This insures that sides will be sheared at right angles to the ends and that the holes will be positioned properly with relation to the sheared edges.

A modification of the shearing rig is shown in Fig. 2. The machine itself if a double-sided multiple, capable of punching over seventy ¾-in. holes at each stroke, and equipped with air-operated gag-moving units. When several different rows of holes are to be punched from one side of the machine, it is necessary that the sheet be turned. This is accomplished by a small air cylinder which can be seen at left almost under the stack. If holes are to be punched in parts of the plate at different heights, the fixture arms may be adjusted for height by means of another air cylinder near the press which has a piston terminating in a channel which supports the two fixture arms. This air cylinder support is supplemented by blocks for a long run without height changes. Another variation in the plate-holding



Rack With Counterweighted Tilting Section FIG.3

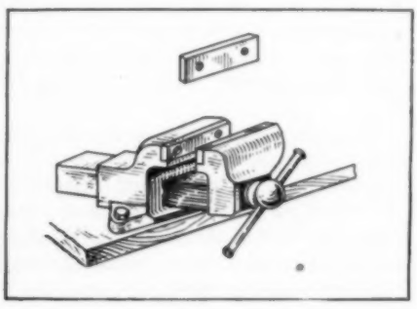
fixture is outlined in Fig. 3, which shows a rack with counterweighted arm. This is used when smaller sheets are punched, such as corrugated hopper car doors for example. The sheets are stacked for punching in the usual way. They are slid out on the extension arm to the shear, then the extension arm is lifted to permit them to be dropped in a pile below. When the pile is completed, the arm is tilted clear back to permit the crane to hoist the pile. The extension arm is built up of angles and plate.

False Jaws for the Vise

F. S. DOUGHTY
Windhill, Shipley, Yorkshire, England

While dealing with some delicate electrical parts, we were using the usual loose vise jaws of copper or lead to prevent damaging the parts held.

It occurred to us to make a change to fiber for the false jaws and to attach them permanently to the vise, as shown in the illustration. The fiber jaws were softer than the ones made of metal and gave a better grip on the small brass parts with less liklihood of damage. One vise among a number, fitted up as described will be an excellent thing for small parts that are likely to be damaged by holding them in metal jaws.



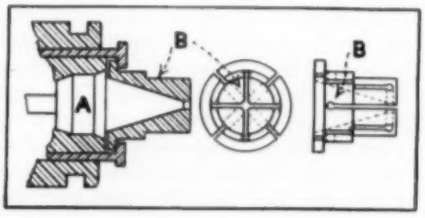
Tools for Chamfering Washers—*Discussion*

JAMES BARNDEN
Brighton, England

I have read with interest the article by Charles Kugler under the title given above (*AM*—Vol. 75, page 213) and the discussion thereon by Harry Shaw (Vol. 76, page 502). From these articles it would appear that the expanding mandrel herewith illustrated is not as well known as it might be.

As shown in the illustration, the mandrel was originally designed for use on the Jones & Lamson flat turret lathe for the second operation on thrust washers. The hardened and ground plug *A* that expands member *B* is firmly held by a draw-in rod. It will be understood that member *B* is slit and is expanded by the action of the automatic chuck, and can therefore be operated in motion.

I have modified the device so that it can be used on Warner & Swasey machines with equally satisfactory results. in this case, the nose cap or collet closer is replaced by the expanding member, which is made to screw on the spindle



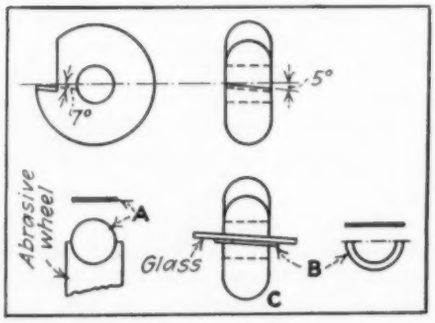
nose. The expanding plug is operated by the collet-closing tube and, as in the Jones & Lamson machine, is capable of severe service. It has the added feature that slight variations in the holes of the washers to be faced do not affect their thickness when using the positive stop for the tool.

Making Contour Forming Tools Without Calculations

CHARLES KUGLER

On reading the article "Contour Calculations for Forming Tools" by C. A. Johnson (*AM*—Vol. 76, page 893), I was reminded of an experience in making contour forming tools for turning the arcs in the inner races of ball bearings. The tools were to have a top rake of 7 deg. and a side rake of 5 deg. as shown in the illustration.

Templets *A* and *B* were made for each



job by the following method: Templet *A* was made by placing a piece of round steel of the same radius as that to be turned in the race, in the universal vise of the milling machine, setting the vise at an angle of 7 deg. in one direction and 5 deg. in the other. At this setting, the end of the steel was milled at those angles. Without changing the setting, a thin slice was cut from the end of the steel by a slitting saw. This templet was used for dressing the grinding wheel for grinding the contour of the tool after it had been gashed and hardened.

Templet *B* was made from a piece of round steel having an axial hole of the same radius as that to be turned in the race. The steel was held in the vise without changing the former setting. After milling the end with an end mill, a thin slice was cut from the end by a slitting saw. This section was cut in two so that the parting line was at the center of one of the pieces, forming a templet for checking the contour of the tool after it had been ground.

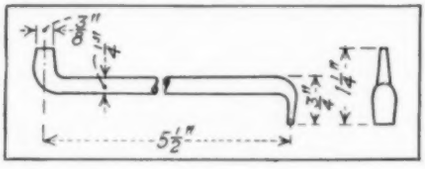
In checking the tool, to insure that the templet was held correctly, a piece of glass was held on the gash and the templet was held under it and against the tool, as at *C*. The glass being transparent, no difficulty was experienced in fitting the templet to the tool. With the tool ground to fit the templet and set in the lathe with the center of its cutting edge on a horizonal line, radial with the work, the groove cut by the tool was semicircular and of the correct radius.

A Screwdriver for Close Quarters

H. D. DAVIES

Many times a slotted-head screw is in such a position that it is impossible to be reached by an ordinary screwdriver. The screwdriver illustrated is the one for that kind of a job. It is simple to make and costs but a few cents.

The material is a piece of 0.80 or 0.90 carbon steel about 7 in. long and the



forging is a fairly easy job for the blacksmith. His job is to make a 90-deg. bend about ¾ in. from each end of the tool, the bends being in the opposite direction from one another. He also forges a screwdriver point at each end, one at a right angle to the other. The shank of the tool can be forged to any shape that will permit a wrench to be used on it for the proper leverage.

SEEN AND HEARD

JOHN R. GODFREY

Slotted Work on a Centerless Grinder

The first centerless grinder I saw was for grinding clevis pins and other plain work for brake rigging—and the pins were as apt to be three cornered as round. That was before we learned where to set the work rests or to use a feed wheel. Now we grind piston pins and the like so round we could call them perfect, if we dared use the word.

The other day I saw a two-diameter job ground on the centerless that had previously been considered impossible. The large diameter had an end slot that took at least a third of the surface, leaving two wide gaps. First attempts were not satisfactory in any way, due to the slotted ends being sprung in hardening. Truing these before grinding and holding the small end with a spring finger does the trick as easily as though they were solid.

Motors for Trucks Must Be Good

Few who have not studied the methods of shops building the best known truck motors can appreciate the precision and careful work that goes into them. Extreme care in balancing seems unnecessary in a truck motor. But those who spend time on it find that it pays in longer life and lower maintenance costs. Trucks and buses are used more continuously and at nearer maximum capacity than passenger vehicles, 10,000 miles a month not being considered a very high mileage. Clutches and bearings receive the greatest care. It would be quite an education to many users of even high priced cars to visit a good truck motor plant, if they are mechanics enough to know good work when they see it.

Flowing Threads for Stud Fits

Threaded fits are always more or less of a problem because of the number of possibilities of error. When we consider that pitch diameter, angle and lead all affect the fit, and add to these the necessity of clearance at top and bottom of thread, except for steam or pressure fits, a perfect fit is one of the miracles that rarely happen. In ordinary thread fits, where the length of engagement does not greatly exceed the diameter, ordinary lead error is relatively unimportant. Recent tests have shown that few threads are correct in angle, due to some extent to the drag of the die. Diameter is easiest of all to maintain. But some are now depending on interference to secure a tight fit in stud work where the thread must stay put in the cylinder block or other part. By cutting the block end slightly oversize and with a 55 deg. angle, the metal flows and fills the thread, making an excellent fit.

Cold Forging

Cold working of metals continues to grow and to create enthusiasm as to possibilities of its development. Steel of about 8 point carbon can be cold forged very satisfactorily. And instead of leaving a scale as in hot forging, cold forging leaves a highly polished surface. While the application of cold forging is limited to a much smaller variety of work than hot forging, its field is being extended and should not be overlooked.

• NEW BOOKS •

MODERN MATERIALS HANDLING—*By Simeon J. Koshkin, Assistant Professor of Machine Design, Cornell University. 488 pages, 5⅞ x 9 in. Indexed and illustrated. Clothboard covers. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price $6.00*

Intraplant transportation is usually included in manufacturing cost and forms a sizable percentage of that cost. Its full significance to industry is sometimes overlooked because of failure to segregate this source of expense.

Written primarily as a university textbook, Mr. Koshkin's work will find use as a reference book for industry at large. After giving a comprehensive classification of equipment used in materials handling, the author devotes the body of the volume to descriptions of each type amply complemented by illustrations. These descriptions include the procedures to be followed in determining capacity or other engineering data commonly needed in selecting and using such equipment.

The problems of material handling are attacked in view of recent developments in this field as exemplified by the chapter on speed reducers and photoelectric control. The pages devoted to belt conveyor design are particularly well arranged.

POWER AND THE PUBLIC—*Edited by Ernest Minor Paterson, Professor of Economics, University of Pennsylvania; President of the American Academy of Political and Social Science. 190 pages, 6x9 in. Indexed. Clothboard binding. Published by the American Academy of Political and Social Science, 3457 Walnut St., Philadelphia, Pa. Price, $2.50; paper binding, $2.00.*

Among the controversial topics before us today are many pertaining directly with the generation and distribution of power. Many proponents of government ownership have singled out this industry as the first logical step in nationalization, pointing to its monopolistic character and its dependence on natural resources. Leading candidates for high public office have taken decidedly opposed views on the subject.

This volume, published as the Annals of the American Society of Political Social Science, forms a rather complete symposium on power control, containing as it does the papers presented at the meeting of the society November 6 and 7, 1931. Widely divergent opinions are expressed, some by those now employed in the management of power companies and others by men frankly critical of the present form of management. In addition to the question of public ownership, the discussions include: the function of holding companies; rates—domestic, commercial and power; Federal and State regulation; valuation; and the future of the electrical industry.

A PRIMER OF MONEY—*By Donald B. Woodward, Formerly Financial Editor of The Business Week, and Marc A. Rose, Editor of The Business Week. 261 pages, 4⅞x7½ in. Indexed and illustrated. Published by Whittlesey House, McGraw-Hill Book Company, New York, N. Y. Price $2.00.*

Few of our standards, so complacently accepted during the boom years, have been above critical scrutiny in the past three. Monetary systems have received varying degrees of blame for the business depression. All of this has led to a desire on the part of the layman for a better understanding of the subject.

Avoiding technical terms and phraseology, Messrs. Woodward and Rose have given a straightforward story of money in what they aptly call a primer. Opening with a historical approach, they show the early need of a substitute for barter. They discuss monetary standards; bimetallism; the gold standard; problems of interest, credit and banking; the Federal Reserve; exchange; and the money market.

This general background brings them to controversial topics on money in its relation to modern business. The lack of flexibility of fixed standard in respect to fluctuating conditions is brought out. The authors make no attempt to suggest a panacea to correct this and other shortcomings of the system under which we now conduct our business and financial transactions, but content themselves with pointing out divergent views and new ideas. They succeed in presenting a simple concise picture on a subject that has become clouded with loose thinking, often because its basic principles are lost to view.

THE WORLD'S AUTOMOBILES 1881-1931. *By G. R. Doyle. 142 pages, 5x7¼ in., paper cover. Published by G. R. Doyle, Meadcroft, Windmill Hill, Ruislip, Middlesex, England. Price $1.75.*

Except for a brief introduction which reviews the beginning of the motor car and illustrates both old and new models, the book is an alphabetical index of the makes of automobiles that have been built from the beginning of the industry. The nationality of the cars is given as well as their span of life. The book refreshes the memory as to cars that are no more and shows the heavy mortality that has occurred in the industry.

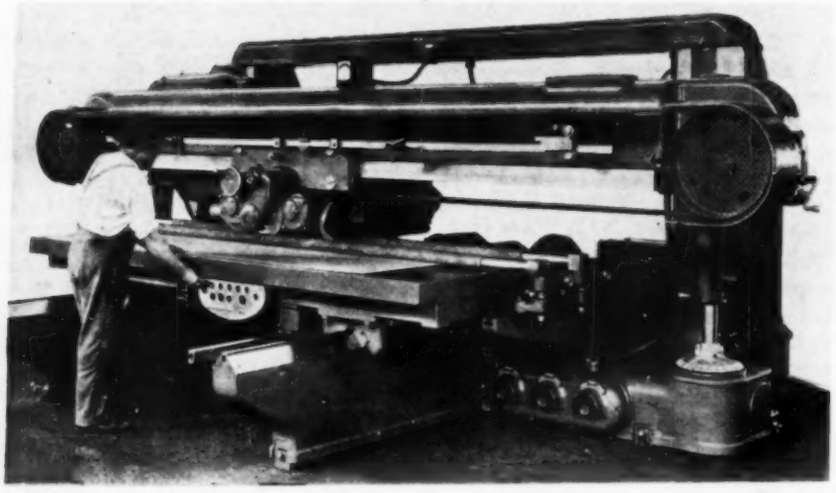
YOU—ME AND BUSINESS. *By L. M. Waite. 46 pages, 6x9 inches. Illustrated by diagrams. Paper bound. Published by Coldfax Publications, South Norwalk, Conn. Price 60c., single copy. Lots of 10—50c. each, lots of 25—45c. each, lots of 50—40c. each, lots of 100—25c. each.*

His many years in the machinery business qualify the author to speak in simple and practical terms of the enigma called business. He starts with an elementary diagram showing the fundamental relations of barter and builds up from this point to the highly complicated structure underlying present-day civilization and trade. The few minutes necessary to read this little book are well spent.

SLUMS, LARGE-SCALE HOUSING AND DECENTRALIZATION. *Reports of Committees on Blighted Areas, Large Scale Operations, Business and Housing and Industrial Decentralization. Edited by John M. Grimes and James Ford. 245 pages; 6x9 in. Published by the President's Conference on Home Building and Ownership, New Commerce Bldg., Washington, D. C. Price, $1.15.*

No one who has the welfare of the country at heart can fail to see how vitally the subjects treated in this volume affect our future. This volume contains the findings of four committees appointed by the President and shows many striking accomplishments in housing as well as the need for more carefully planned work along the same line. Examples include the work done in cities of various sizes, from Bridgeport to New York, the material given being excellent for argument in securing backing for such enterprises and for aiding in their execution. Business men will be particularly interested in the section on decentralization. The committee does not advocate a wholesale and undirected decentralization of industry. It does, however, endorse the benefits of well considered decentralization where it is economically feasible and where the housing problems can be well worked out. While one may not agree with all the findings of these committees, it is encouraging to know that definite action is being taken to make information on the subject available to all.

SHOP EQUIPMENT NEWS



Mattison No. 405 Abrasive-Belt Surface Grinder and Polisher

The No. 405 abrasive-belt surface grinder and polisher has been introduced by the Mattison Machine Works, Rockford, Ill., for the purpose of surfacing and polishing stainless steel sheets. Abrasive belts over 40 ft. long work under heavy cutting pressure to assure maximum cutting efficiency. A heavy crossrail mounted on the columns carries tracks on which the carriage travels. The main driving motor mounted on the carriage head drives the contact roll which in turn drives the belt. Idlers at each end of the machine give adjustments for aligning and tensioning the belt.

The water-cooled table is mounted on ball-bearing rollers and has power movement through a screw. A sheet is held by two spring-loaded, cushioned, hold-down rolls located one near each side of the belt. The cut is made between these hold-down rolls, so that the sheet is always held flat at the working point. In operation the carriage reciprocates, bringing the contact roll into play on the work from end to end of the sheet, and the table moves slowly crosswise, bringing the whole width of the sheet under the roll.

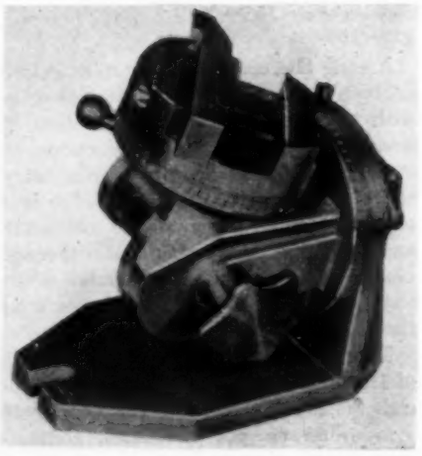
"Tool Metals" No. 100 Grinder and Universal Vise

For use in fabricating tungsten-carbide tipped tools, Tool Metals Co., 439 E. Fort St., Detroit, Mich., has developed a No. 100 grinder and a full universal vise. The grinder is equipped with two tiltable 30-deg. tables graduated and arranged with 4½ in. movement. This movement enables the operator to dress the wheel correctly, besides feeding the tools to the wheel. Both tables are provided with grooves to guide the diamond dresser. The machine is equipped with two 12 in. by 4 x 2 in. ring wheels, one for roughing and the other for finishing. A diamond lapping disk can be supplied. The machine takes ½ hp.

The full universal vise for grinding and milling toolbits and miscellaneous work has three sets of graduations for obtaining various angles in six directions. The device can be used on surface grinders and milling and drilling machines. It is made in 4- and 6-in. sizes. A diamond holder for truing grinding wheels is built in. A 3-jaw chuck can be furnished.

Cutler-Hammer Control for Press Drives

Cutler-Hammer, Inc., 12th & St. Paul Ave., Milwaukee, Wis., has developed a simplified system of control for operating electro-magnetic clutches and brakes applied to punch and forming presses. The patented safety feature is a plurality of palm-operated pushbuttons, mounted directly on the slide of the press. This insures that each hand of each operator



will be occupied in holding a button depressed, and consequently free from the press when the slide is descending. Flexibility of control is obtained by providing three additional methods of operation with simple means of transfer to any one of the four methods desired. The control may be operated for inching, or may be set to operate an automatic feed mechanism continuously or to take the slide through one complete cycle by momentarily depressing the run buttons. An emergency stop bottom is also provided.

Carboloy "Milled and Brazed" Service

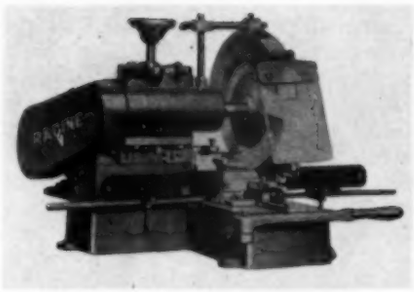
To reduce the cost of Carboloy cemented carbide metal-cutting tools, the Carboloy Co., Inc., 2481 E. Grand Blvd., Detroit, Mich., now has a plan known as "Milled and Brazed Service," whereby milled and brazed Carboloy tools are furnished the same as regular finished tools except that they require a small amount of grinding. Thus, the user can obtain Carboloy tools at less than the regular finished tool price and save a large part of the difference in cost.

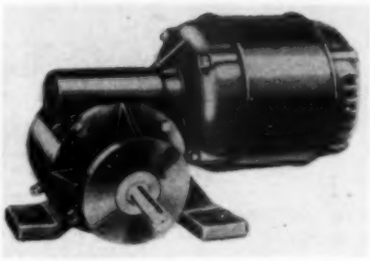
"Pro-Tek" Protective Hand Cream

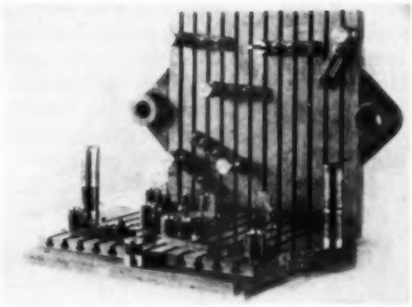
The DeVilbiss Co., Toledo, Ohio, has developed a white protective cream for men who have their hands in such stubbornly adhering materials as lacquer, paint, varnish, grease, oil and similar materials. This product, known as "Pro-Tek," is rubbed into the skin before working to form a protective film. The film is soluble only in water, and sticky substances and soiling materials are powerless to penetrate it. The material is not harmful to the skin.

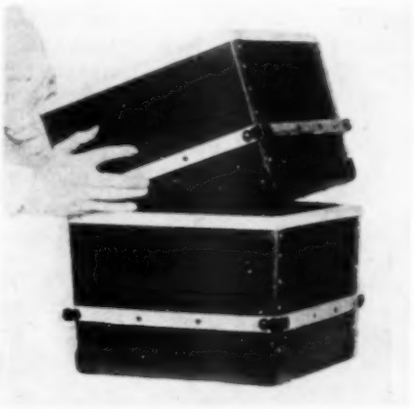
Racine Hacksaw-Blade Grinder

For grinding high-speed steel hacksaw blades, the Racine Tool & Machine Co., Racine, Wis., has introduced a grinder that may be used to regrind each blade three to six times. The wheel remains in a fixed position, and the blade is fed across the wheel. The indexing gage used to advance the blade has double fingers to provide positive advance of the blade on every stroke of the operating handle, even when three teeth in the blade are missing at any one point. After the machine is set, the wheel dressed and adjusted, all similar blades may be reground in from 1 to 1½ min. each. Teeth are slightly undercut. Capacity of the machine is from blades 1 to 2 in. wide by any length.









Janette Type SW-2 Speed Reducer

Type SW-2 motorized speed reducer, added to its line by the Janette Mfg. Co., 556-558 W. Monroe St., Chicago, Ill., consists of a ball-bearing Janette motor mounted integrally with a worm gear reduction unit. The slow-speed shaft is fitted with tapered roller bearings. Twelve ratios, ranging from 90:1 to 8:1 have been adopted as standard, although intermediate ratios and others up to 120:1 may be furnished. Motors of 1/6 to 1 hp. are obtainable. Standard motor speeds are 1,725 to 1,140 r.p.m.

"SM" Elapsed Time Indicator

Announced by the Automatic Switch Co., 6420 E. Lafayette Ave., Detroit, Mich., is the "SM" elapsed time indicator, which is adapted for use as a lost time indicator on production machines. In connection with Veeder counter to indicate the number of pieces produced, the elapsed time indicator gives correct data for time study. On electric welding sets, it indicates directly the amount of non-productive time. Drive for the indicator is by a self-starting synchronous motor. The device is available for use on 110 and 220 volts. Bulletin 210 gives a complete description.

Whistler Perforating Die

S. B. Whistler & Sons, Inc., 752-754 Military Road, Buffalo, N. Y., has devised a perforating die that can be adjusted to pierce metal up to ⅛ in. thick in any arrangement or group of holes that may be desired. Relocation of the punches and dies can be made within a very short time, and all punches and dies may be replaced or changed while dies are in the press without disturbing the set-up.

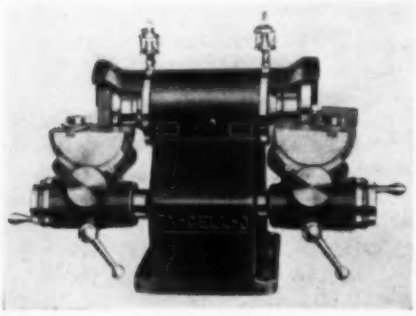
Spaulding Fibre Nesting Boxes

For transporting small parts in the shop, the compact nesting boxes shown below have been placed on the market by the Spaulding Fibre Co., Inc., Tonawanda, N. Y. These boxes are made of fibre board, solid riveted, with steel reinforcement at the corners and top edges. The size is 13x13x9 in. They are lacquered, and because of the material are light in weight yet strong.

Ex-Cell-O Grinder and Lapper for Precision Carbide Tools

A compact grinder and lapper designed for precision tungsten-carbide tipped boring tools has been developed by the Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich. The holding of correct tool shapes and maintaining of sharp tools is important in order to obtain best results. General-purpose carbide tools can be sharpened.

The inbuilt balanced motor has double shaft projections for the grinding wheel and the lapping disk. The ring-type

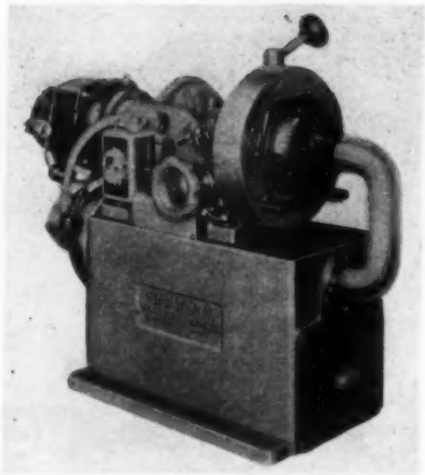


grinding wheel is mounted on a steel back plate, and is 6 in. in diameter with a 1¾-in. grinding surface. The special cast-iron lapping disk is 6 in. in diameter, ¾ in. thick with a 1¾-in. lapping surface on the front side of the disk and a ¾-in. lapping surface on the back.

An adjustable table is provided on each side of the machine. Brackets supporting the tables are mounted on a common shaft, and each bracket has a horizontal micrometer adjustment. The table proper is mounted on a circular dovetail slide graduated for adjustment. Parallel with the face of the wheel there is a slot milled in the face of the table to guide the tool support. The face of the tool support is flat, permitting the tool to be held rigidly by hand during grinding or lapping, and the parallel guide permits a lateral movement of the tool across the face of the wheel or disk. An angular graduation is also provided on the tool support.

"Cimatool" Bench-Type Diamond Boring Machine

The City Machine & Tool Works, East Third at June Sts., Dayton, Ohio, is marketing a bench-type machine for boring operations on bronze or babbitt bushings in the end frames of small electrical motors, boring wrist pin bearings in refrigerator pistons and



similar operations. Holes up to ¾ in. are bored.

The machine is semi-automatic in operation. The work is put in position in the chuck, and one of the two electric switches is pulled forward to energize the chuck. The operator then pushes the exhaust tube against the end of the work so that borings may be carried away by a special exhaust system. Next, the operator closes the second electric switch whereby the machine is started through a cycle of automatically controlled operations. The starting switch is inoperative unless the chuck is energized. After the bore has been completed, an automatic trip opens the switches and an electrically operated brake stops the rotation of the spindle, and the spring returns the spindle to the starting position.

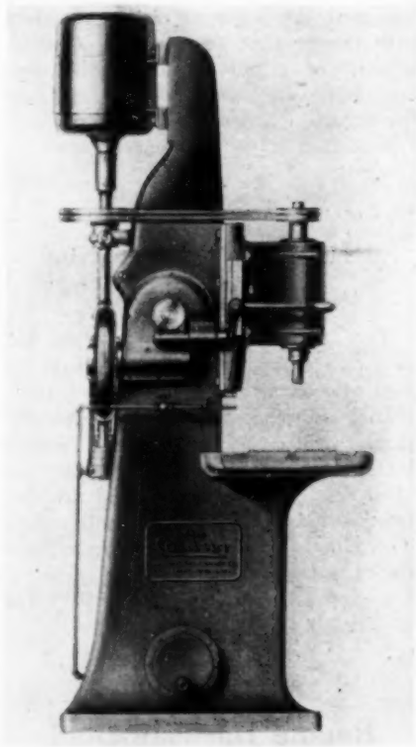
Fafnir Extra Small Series Ball Bearings

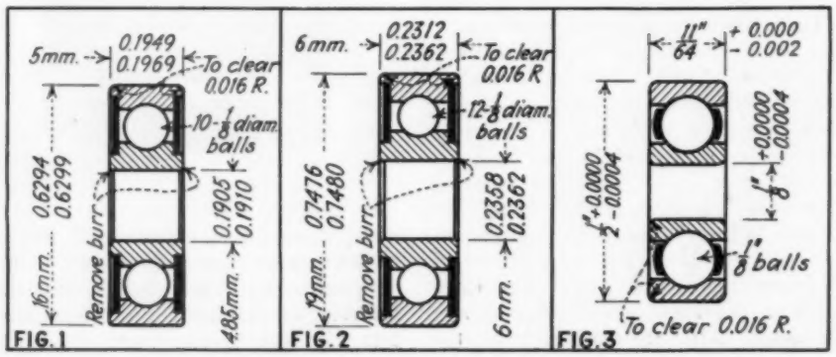
Extra small series ball bearings in the seal type have been announced by the Fafnir Bearing Co., New Britain, Conn. The double seal type, Fig. 1, is of the full type for maximum static capacity and comes packed with lubricant. The double seal type, an intermediate small size, Fig. 2, is also of the full type. The miniature design, a small, light ball bearing adapted to instruments and other light, delicate bearing applications, is shown in Fig. 3. These three bearings were designed particularly for aircraft applications but are of use elsewhere.

Coulter Cam-Feed Vertical Diamond Boring Machine

The Automatic Machine Co., Bridgeport, Conn., has added to its line a Coulter diamond boring machine made in two sizes, each equipped with single or double spindles. In the double-spindle design, the spindles are adjustable, center to center for two holes in one piece, or for boring holes in two pieces simultaneously.

The feed mechanism is by a cam similar in design to those used on automatic screw machines of the B&S type, whereby roughing or coarse feed on the

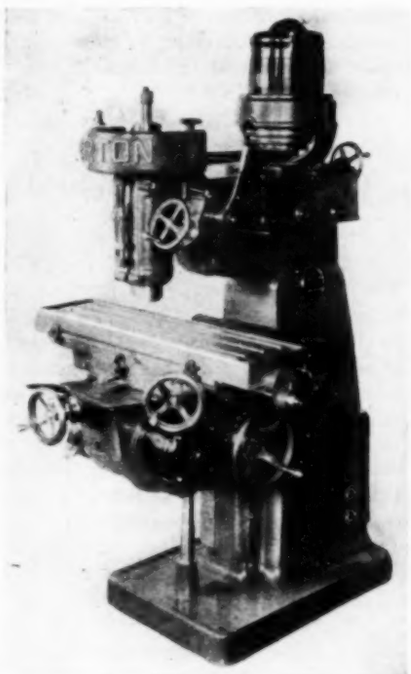




down stroke and a finer feed on the up stroke are secured. The boring spindle is equipped with removable bar ends to suit the diameter and length of hole to be bored, and is provided with a fine adjustment to the boring tool, graduated in ten-thousandths. A 1½-hp. motor drives the spindles direct, feed mechanism and lubricating pump.

Gorton No. 9-J Vertical Milling Machine

Designed to run small cutters at high speeds on tool, die and mold work, the No. 9-J vertical milling machine has been introduced by the George Gorton Machine Co., Racine, Wis. The machine drives to capacity high-speed steel cutters from ⅛ to 2 in. diameter. It is said that it will handle small work economically, and also takes heavy cuts at feeds



and speeds comparable to those obtained on Nos. 1 and 2 vertical millers.

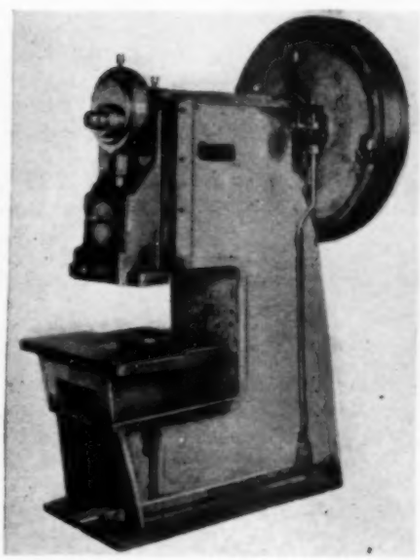
One of the principal features is the sliding head, which carries the spindle and drive complete, and which can be quickly adjusted in or out by means of a rack and pinion, thereby doubling the area covered at one setting of the work. An optional feature is the power or hand feed to the table. In this machine the motor and gearbox for table feed are assembled within the knee. A power feed knee can be furnished or a plain knee substituted without affecting other parts of the machine. Feeds from 4/10 in. to 30 in. per min. are obtained with the power feed knee. Spindle speeds range from 250 to 4,000 r.p.m. in 20 steps without back-gears, changing pulleys, or special motors. The spindle is mounted on precision ball bearings, and has a No. 10 B&S taper. The spindle has a quick-action lever or micrometer dial feed. Drive is through an endless V-belt from a 2-hp. vertical motor. The machine is equipped with a spindle pulley brake. The spindle has a positive micrometer depth stop graduated in thousandths.

Specifications: Table longitudinal feed, 24 in.; cross feed, 12 in.; sliding head movement in and out, 14 in., making a combined cross feed of table and sliding head of 26 in.; vertical feed of knee, 14 in.; vertical feed of cutter spindle, 3½ in.; height of machine, 81 in.; weight, 2,900 lb.

"Service" Welded-Steel Deep-Throat Punch Press

The Service Machine Co., 754 Broadway, Elizabeth, N. J., has placed on the market a 50-ton welded-steel frame press known as the P-27½. This machine operates at 125 r.p.m. as a maximum, and is designed particularly for heavy punching and stamping operations. The deep-throat design permits handling of work of large area. A bolster adapter is regularly provided to give a wide range of shut height capacity. An adjustable bed can be provided for use on lighter classes of work.

The slide has a wide and deep bottom face with a hole for 3-in. shanks. Two different centers are provided, the regular shank center giving depth of throat of 18¼ in., and the front extension center giving a depth of throat of 20¼ in. The eccentric can be interchanged quickly for various lengths of stroke by removing the nut on the front of the shaft. Any stroke up to a maximum of 4 in. can be provided. Adjustment to the slide is 3½ in. With standard stroke of 3½ in., the shut height above the bolster adapter ranges from 5½ to 9 in., and above the bed from 15½ to 19 in. Provision is made for the use of knockout bars. The press has a base 24x48 in., a bolster area of 32x25 in., and a bed area of 20x25 in.

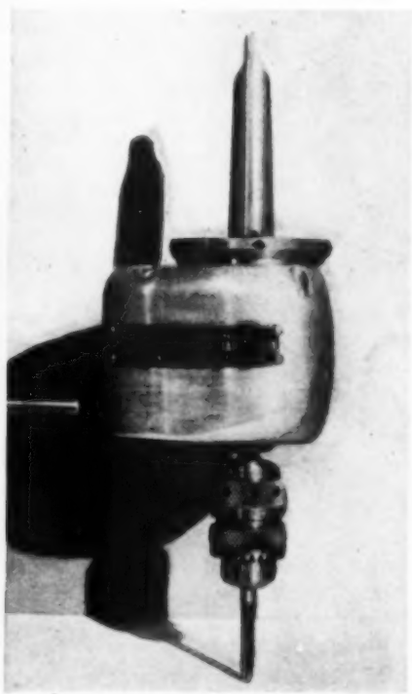


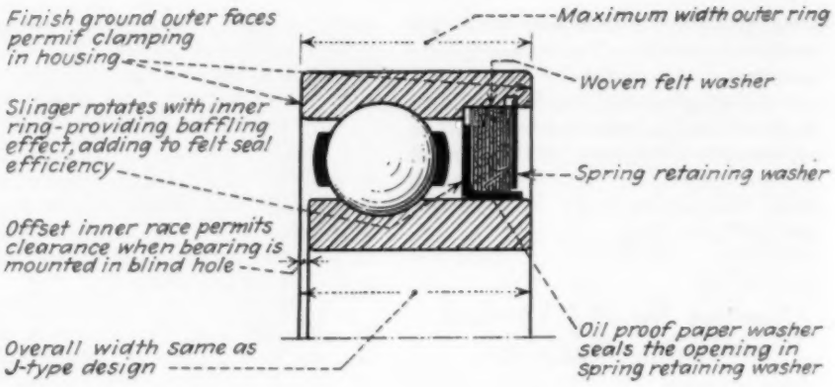
Garlock 660 Sheet Packing

No. 660 sheet packing for gasoline, oil or water has been announced by the Garlock Packing Co., Palmyra, N. Y. The packing incorporates granulated cork with tough paper fibre. It is resilient and soft enough to seal flanges or joints which may be imperfectly machined or in poor condition. It is manufactured in all standard thicknesses from 0.010 in. to ½ in.

Biax No. 0 Tapper

A high-speed tapper operating at 3,500 r.p.m. maximum speed and having capacity from No. 2-56 to ¼ in. in steel has been announced by The Charles L. Jarvis Co., Gildersleeve, Conn. The Biax No. 0 tapper is equipped with ball bearings throughout and has Textolite, self-adjusting clutches. It is also equipped with reverse at double speed and double friction. Gears are of chrome-nickel steel, hardened and ground. The chuck is of the Jacobs double-grip type, holding the square as well as the shank. On a production test, the tool tapped 4,000 ⅞-in. holes per hour.




Finish ground outer faces permit clamping in housing
Maximum width outer ring
Woven felt washer
Slinger rotates with inner ring - providing baffling effect, adding to felt seal efficiency
Spring retaining washer
Offset inner race permits clearance when bearing is mounted in blind hole
Oil proof paper washer seals the opening in spring retaining washer
Overall width same as J-type design

Right — Fafnir T-Type Felt-Seal Bearing which differs from the J-Type in having the felt seal inside the outer race and no external shell

Philadelphia Vertical Motoreducer

Similar to the horizontal-type motoreducer (*AM*—Vol. 76, p. 1051), the vertical-type motoreducer, announced by the Philadelphia Gear Works, Erie Ave. at G St., Philadelphia, Pa., is suitable for driving agitators, mixers and other machinery. Minimum headroom is required because of the compact design. The reducer is available in single, double and triple types with ratios up to 450:1.

Sommer & Adams Automatic Clevis Drilling and Tapping Machine

Brake rod clevis yokes are spotfaced, drilled and tapped on the fully automatic machine built by Sommer & Adams Co., 18511 Euclid Ave., Cleveland, Ohio. Production on the ⅞-in. S.A.E. standard drop-forged clevis is 1,000 per hr.

The clevis is hopper fed four at a time at the loading station. Four tools are mounted in each of the three machining stations. At the first station the parts are centered and spotfaced; at the second, drilled; and at the third, tapped. Parts are automatically ejected. The cutting tool spindles are advanced by an overhead cam which is changed for different pitches. Automatic chuck jaws are changed for different diameters.

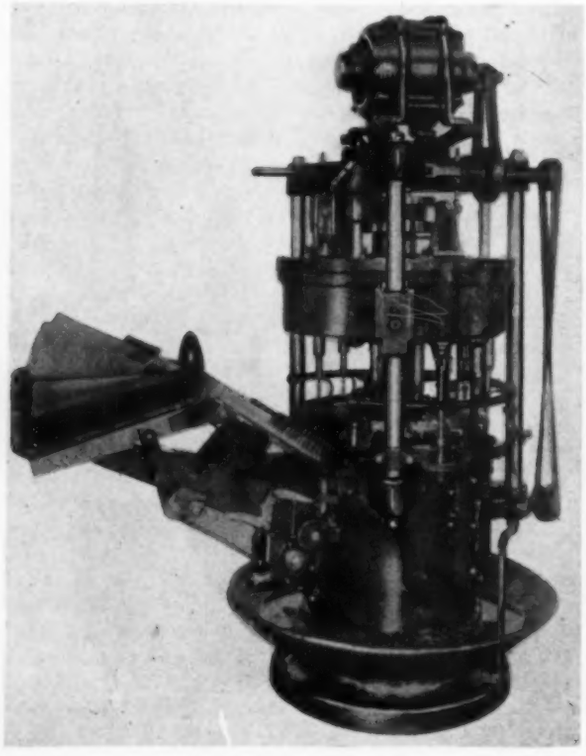
"Cimatool" Diamond or Carbide Boring Machine

For boring holes up to 6 in. in diameter with diamond or carbide tools, the City Machine & Tool Works, East Third at June Sts., Dayton, Ohio, has introduced a "Cimatool" diamond or carbide boring machine. This machine is built in both single and double-end types and with one or more spindles. It finds application for the boring of large sizes of pistons, connecting rods, motor frames and cylindrical valves.

The revolving spindle remains stationary while the work is carried on a reciprocating table that is fed to the spindle. Operation is semi-automatic, and provision is made for quick traverse of the work to the boring tool, and in cases of interrupted bores for quick traversing of work across such gaps. Required sequences of traverse and feed movements are obtained by stops on the table, which operate hydraulic valves. Editor P; Dept. S.E.N.

Fafnir T-Type Felt-Seal Bearing

Announced by the Fafnir Bearing Co., New Britain, Conn., is an improved T-type felt-seal bearing, which is said to meet the needs of designers and users more fully than the J-type announced two years ago. Analysis of operating requirements has indicated the advisability of placing the felt seal inside of and located by the outer ring, allowing the pressed steel shell as formerly fitted over one face of the bearing to be done

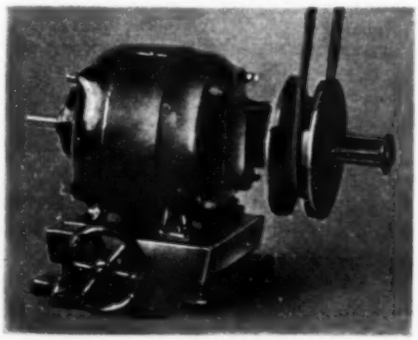


away with. A more standard closure and a more effective sealing device is the result.

By extending the width of both the inner and outer ring on one side of the ball race in this T-type bearing, space is provided for the fitting in of the entire seal assembly between two rings. A steel slinger is first pressed on the inner ring, a woven felt washer placed next to it and held in position by a spring retaining washer fitted into a slight groove on the inside of the outer ring. An oil-proof paper washer is slipped in between the felt and retaining washer to seal the opening in the latter.

"Acme" V-Belt Drive

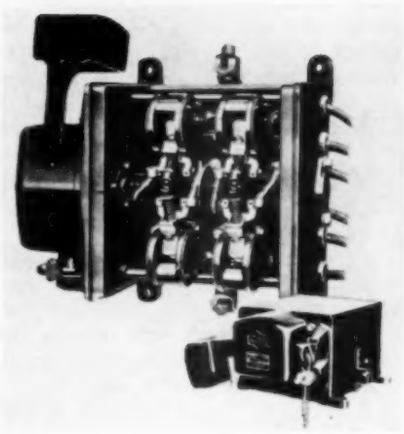
N. J. Oak, 22 Hawthorne St., Lynn, Mass., has introduced an "Acme" V-belt drive which consists of a motor on an adjustable base and a cone arrangement on the extended motor shaft. Both of these cones have wide slots extending radially so that the raised portions left thereby act as driving members on the



V-belt. The outer disk, or cone, moves axially on the shaft and is urged toward the stationary disk by means of a spring. As the load on the belt increases, the belt is wedged down between the disks to a greater extent and the spring causes the disks to grip the belt under constant pressure. It is said that the design is applicable to drives from ½ to 40 hp. The motor is adjustable on the base to compensate for stretch of the V-belt.

Cutler-Hammer Crane Limit Stop

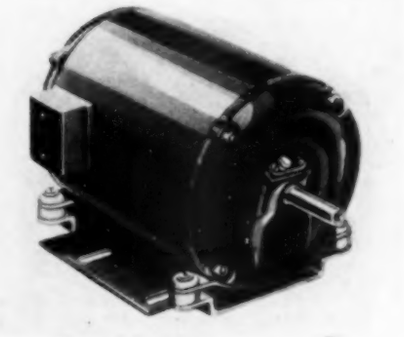
A small-size crane limit safety stop, with standard mill-type blowouts and contact tips, has been developed by Cutler-Hammer, Inc., Milwaukee, Wis. These stops are used to prevent overtravel of the hoist on electric cranes. Rated for 40 hp. and under, it is said that the stop is ususually small and compact for this rating, taking only 9-in. of



headroom. The stop is supplied complete with leads equipped with soldering lugs. The cover is removable for inspections and repairs.

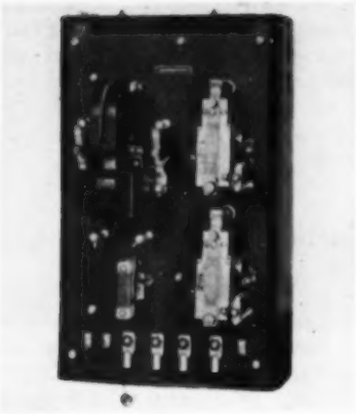
Howell Fractional-Hp. Capacitor Motors

Built-in capacitor motors of the long-hour-duty type have been announced by the Howell Electric Motors Co., Howell, Mich. Horsepower ratings range from ⅛ to ½, full-load efficiency from 55 to 64 per cent, and full-load power factor from 64 to 69 per cent. Starting torque is from 465 to 330 per cent of the full load torque. The motors are compact and neat, quiet, and have a protected frame. They are built in vertical designs with machined register mounting or with flange mounting and in a horizontal rubber-mounted type.



General Electric Mill-Type Starters

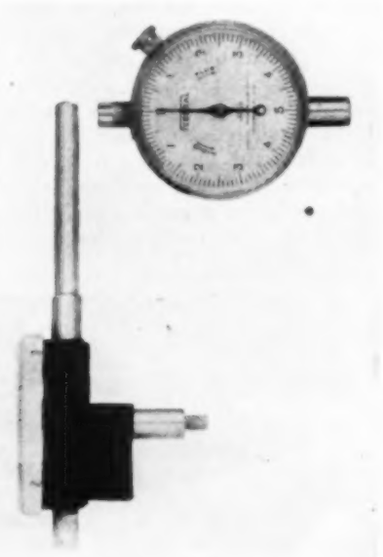
A line of general-purpose mill-type starters for constant-speed d.c. motors has been announced by the General Electric Co., Schenectady, N. Y. These starters utilize newly developed accelerating contactors which have been designed not only to act in the capacity of a relay to provide time delay, but also to short out the starting resistor by means of a contact finger. The accelerating contactor, therefore, replaces two conventional devices, namely, the accelerating relay and the old accelerating contactor.



These starters are simple in design to cut maintenance cost, and the accelerating contactors are equipped with silver-faced tips so as to eliminate oxidation difficulties. They are available in sizes from 1 to 75 hp.

Federal Model 82 Dial Indicator

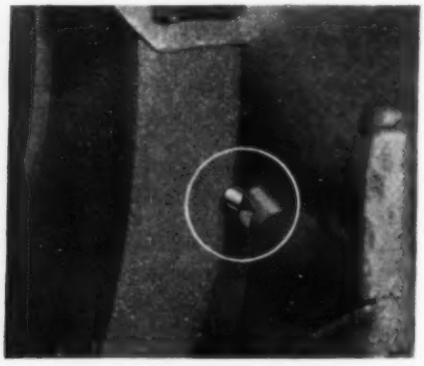
A dial indicator graduated in ten-thousandths, and having a spindle operating through the center of the back instead of through the side of the case as is customary, has been developed by the Federal Products Corp., 1144 Eddy St., Providence, R. I. This dial indica-



tor is known as the Model 82, and has a range of 0.020 in. The dial can be furnished with calibrations of either 0-5-0 or 0-10. Furthermore, the indicator can be furnished either with a jeweled bearing movement or with a plain bearing movement.

Carboloy Truing Tool for Grinding Wheels

Finish dressing of grinding wheels is the function of the truing tool introduced by the Carboloy Co., Inc., 2481 E. Grand Blvd., Detroit, Mich. This tool fits all standard holders for hand or machine truing. It has a matrix impregnated with small, crushed diamonds. Range of wheel sizes and types on which the tool has been used covers wheels up to 36 in. in diameter by 2 in. wide and to "M" in hardness. On centerless grinding wheels, sizes up to 20 in. in diameter by 6 in. wide can also be finished. Over-all length of the tool is 1½ in., and the diameter is ½ in.



Metalspray Gun

An improved gun for spraying various metals to build up machine parts or provide corrosion-resistant coatings has been placed on the market by the Metal Spray Co., 113 Llewellyn St., Los Angeles, Calif. In this gun the air turbine and reducing gears are inclosed in a separate aluminum case, and the wire-feeding wheels, gas mixing chamber and nozzle are separate units. The design aims at eliminating wire metal particles from causing excessive wear to the worm gears, and of obtaining visible control of the wire feed. Independent valve controls for oxygen, acetylene and air, as with a welding torch, instead of a single valve, control all three gases. The gun has capacity for taking wire from 12 gage B. & S. to ⅛ in. diameter. Volume of deposit is therefore much larger than ordinary.

All surfaces to be coated are sandblasted to clean the surface and to provide minute "key-fasts." Molten particles impact at such high velocity and force that very intimate bonds result, said to be comparable to electroplating or hot-dipping, except that any desired thickness may be secured. The guns operate at from 10 to 20 lb. acetylene pressure, 15 to 25 lb. oxygen pressure, and 80 to 90 lb. air pressure. Impervious coatings may be secured with most soft metals from 0.002 in. to 0.006 in. Hard metals usually require heavier coatings. The device is made in three sizes or models.

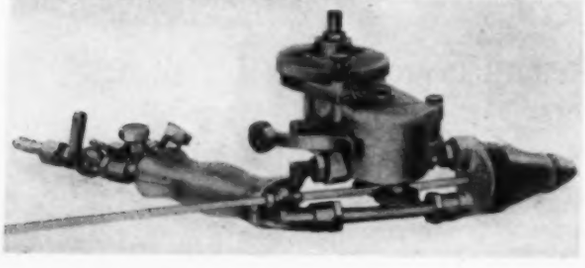
Heald Tool Sharpening Machine

For convenience of users of its "Borematic" precision finish boring machine, The Heald Machine Co., Worcester, Mass., has developed a tool sharpening machine that is automatic in operation. Once having set the toolholder for the desired clearance angle and the wheel for the radius, the operator merely inserts the tool in the holder, turns the switch and the tool is sharpened automatically. One toolholder with adapters for $\frac{7}{32}$ in., $\frac{5}{16}$ in., ⅜ in. and ½ in. diameter tools is furnished.

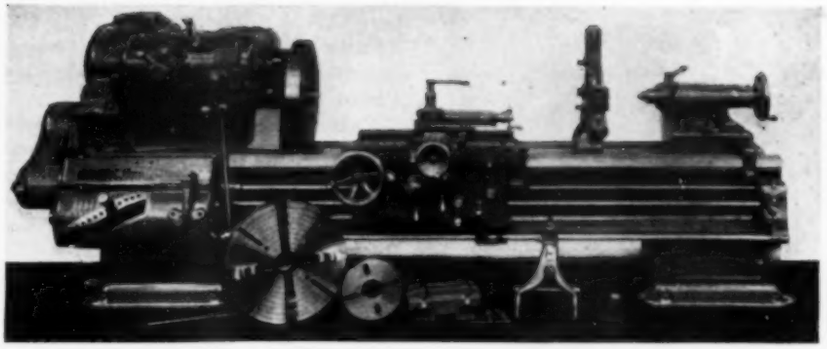
The ¼-hp. motor in the base carries a two-step grooved pulley. The larger step is belted to a pulley that drives the lapping wheel. The smaller step drives a cam through a worm gear drive. This cam provides movement for a T-slotted arm. The latter is connected by a cable to a drum that oscillates the tool bracket. The T-slotted arm is connected to the lapping wheel bracket by a rod with ball and socket joints and thus oscillates the lapping wheel. A special iron impregnated with diamond dust is employed for the wheel, which is carried on a spindle that runs in ball bearings. The wheel spindle bracket swings on hardened centers and is adjustable horizontally. It sets the face of the wheel to the center of the oscillating movement of the tool. This makes it possible to obtain the amount of radius required. A scale on the tool bracket support provides a means of setting to obtain the required clearance angle on the tool.

Webber Precision Gage Blocks

Guaranteed to be within 8 millionths of an inch of the marked size, the majority running between +3 and +6 millionths, a line of precision gage blocks has been developed by the Webber Gage Co., 2517 Vestry Ave., Cleveland, Ohio. The cost of finishing these blocks having been reduced, they are said to be low in cost. Set No. 81B, shown in a case, has a range from 0.100 in. to 12.0000 in. Set No. 5B has a range from 0.100 in. to 2 in. by 0.100 in. increments. Set No. 35B has a range from 0.100 in. to 5.0000 in. While not a complete gage set, it is suitable for checking snap gages, setting sine bars, comparators, and the Zeiss optometer. Each of the cases has the "tilt-block" feature, by which when the gage end is depressed the other end tilts up so that it may be grasped easily without touching it with tools.



Springfield 24-in. Geared-Head Engine Lathe



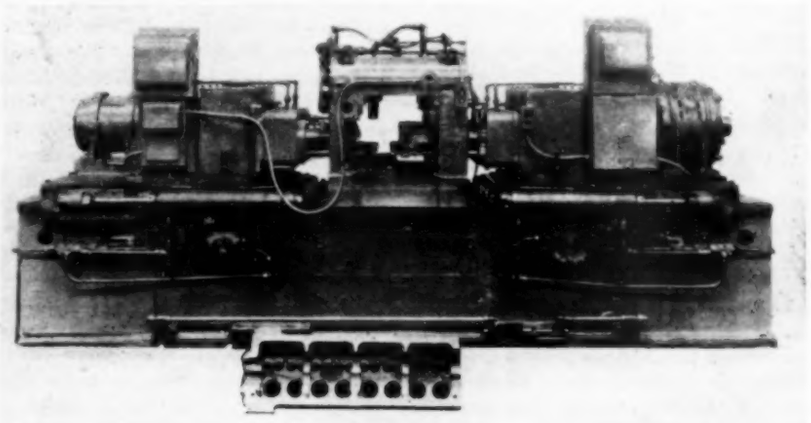
Twelve changes of speed in the headstock, and 36 changes of threads and feeds in the gearbox, are provided on the 24-in. geared-head engine lathe developed by The Springfield Machine Tool Co., Springfield, Ohio. The headstock employs hardened and lapped gears running in oil. Large Timken precision roller bearings carry the spindle. Hole through the spindle is 2⅜ in.

The gearbox is provided with a centralized oiling system, sending oil to all bearings from two reservoirs. The apron has heavier gears, friction pull feed handles guarded from dirt and to prevent injury to the operator and a centralized oiling system. The system oils all bearings from reservoirs and filters the oil through felt. The bed has been increased in width by 2 in. With a 12-ft. bed the lathe weighs 11,450 lb.

Baker Nos. 6-HH and 8-HH Horizontal Production Drilling Machines

Continuing its development of the production-type horizontal way machine, Baker Bros. Inc., Toledo, Ohio, now announce the No. 6-HH and 8-HH two head drilling machines. The accompanying illustration shows the No. 8-HH machine set up for the operation of drilling from two ways the 16 valve holes in an eight-bore motor block.

In these machines, standard saddles are mounted on each end and are arranged with drive brackets for the multiple-spindle heads. Heads designed to suit the work are mounted on the front facings of the drive brackets. The machine bed is made of sufficient length with plenty of head travel to allow using the machine for other work. Each end of the machine has its own oil-feed unit and also the "Twin Pull" feed with two cylinders out in the open for quick adjustment and repair. All machines are arranged with an automatic cycle, being started by a treadle at the front. Cycle control trip blocks are placed on the saddles in accessible position. Feeds can be changed by means of two metering valves, one at each end. A lubricant pump is mounted on each drive bracket to give automatic lubrication to all bearings and gears in the heads. Spindles are mounted on ball bearings with provision in each spindle for in and out adjustment for tool setting. Clamping of the work is accomplished through hydraulic means.



Baker No. 8-HH Two-Way Drilling Machine set up for drilling 16 valve holes in an eight-bore motor block. This machine with fixture weighs 17,000 lb.

"Wel-Don" End Mill

For rapid production of keyways, a special form of end mill has been designed by the Weldon Tool Co., 1426 W. Third St., Cleveland, Ohio. This

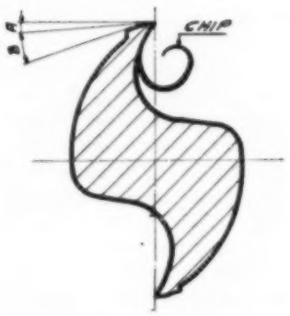


Diagram showing double "back-off" on cutting edges of mill to minimize chatter

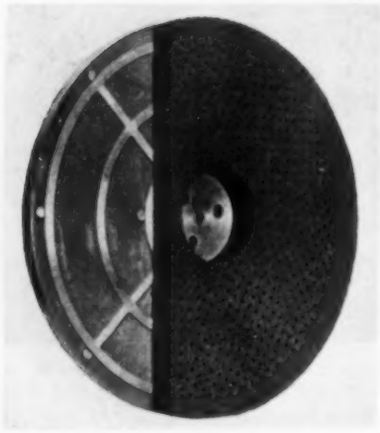
tool has cutting edges at the ends as well as at the sides and has no center hole. It can be fed downward like a drill as well as horizontally, thus avoiding preliminary drilling and taking several cuts to gain the required depth.

Lunkenheimer Bottle Oiler

Three major parts—a glass bottle with threaded neck, a bronze base with integral sleeve-type shank, and a brass feed wire—are employed in the bottle oiler announced by The Lunkenheimer Co., Cincinnati, Ohio. A thick resilient cork washer seals the joint between the bottle and the base. This type of oiler supplies the correct amount of oil for the lubrication of plain bearings. It feeds only when the shaft is in motion. One filling of oil lasts for a long time and is always visible. Bulletin No. 532 gives complete details.

Titan Bakelite Perforated Steelbac Grinding Wheel

To provide clearance and to give the grindings an opportunity to escape, perforations are provided in the face of the "Titan Steelbac" grinding wheel



announced by Charles H. Besly & Co., 118-124 N. Clinton St., Chicago, Ill. By a process of forcing the holes into the disk, lateral pressure is exerted on the grains. It is said that this brings them closer together and produces a denser, stronger structure. The holes extend almost to the steel backing. Perforated Steelbacs are 1, 2 and 3 in. thick above the ridges or beads in the Steelbac plate and can be worn down to the plate. Steelbacs above 42 in. in diameter are made in eight sections which are easily attachable.

• PATENTS •

OCTOBER 18, 1932

Metal-Working Machinery

Shaping Machine. Robert H. Anderson, San Diego, Calif., assigned to A. B. Bowman. Patent 1,882,711.

Grinding Machine. Frederick S. Haas, Cincinnati, Ohio, assigned to the Heald Machine Co. Patent 1,882,814.

Grinding Apparatus. Leo C. Shippy, Anderson, and Louis C. Goad, Muncie, Ind., assigned to Delco-Remy Corp. Patent 1,883,016.

Lathe. Gustaf David Sundstrand, deceased, Rockford, Ill., and John F. Benner, Rockford, Ill., assigned to Sundstrand Machine Tool Co. Patent 1,883,082.

Machine Tool. Ernest J. Svenson, Rockford, Ill., assigned to Sundstrand Machine Tool Co. Patent 1,883,084.

Grinding Machine. Gerard A. De Vlieg, Rockford, Ill. Patent 1,883,612.

Tools and Attachments

Gear Holding and Centralizing Device. Gherald D. Scott, Worcester, Mass., assigned to The Heald Machine Company. Patent 1,882,997.

Live Center for Lathes, Grinders and the Like. Adolph Storm and Thor Thorsen, Minneapolis, Minn., assigned to Storm Manufacturing Co., Inc. Patent 1,883,075.

Punch and Die for Roller Bearing Cages. Silas A. Strickland, Detroit, Mich., assigned to Bower Roller Bearing Co. Patent 1,883,079.

Tool Holder. Gerard A. DeVlieg, Rockford, Ill. Patent 1,883,611.

OCTOBER 25, 1932

Metal-Working Machinery

Thread Milling Machine. Ernest J. Lees, Cleveland, Ohio, assigned to the Lees-Bradner Co. Patent 1,883,995.

Hydraulic Press. Howard F. MacMillin, Mount Gilead, Ohio, assigned to Hydraulic Press Manufacturing Co. Patent 1,884,060.

Grinding Apparatus. Charles H. Schurr, Cleveland, Ohio, assigned to the Lees-Bradner Co. Patent 1,884,293.

Riveting Mechanism. Richard W. Dinzl, Margate City, N. J., assigned to Southwark Foundry & Machine Co. Patent 1,884,611.

Tarry Mechanism for Grinding Machines. Harold E. Balsiger, Waynesboro, Pa., assigned to Landis Tool Co. Patent 1,885,070.

Tools and Attachments

Work Holding Means for Turning Machines. Charles H. Landers, Lansing, Mich., assigned to General Motors Corp. Patent 1,883,977.

Scrap Cutter for Punch Presses and the Like. George H. Leland, Dayton, Ohio, assigned to the Leland Electric Co. Patent 1,883,996.

Milling Cutter. Carl G. Olson, Chicago, Ill., assigned to Illinois Tool Works. Patent 1,884,158.

Multiple Drill Head. Henry R. Krueger, Detroit, Mich., assigned to Ex-Cello-O Aircraft & Tool Corp. Patent 1,884,752.

Chuck. Alfred E. Hamilton, Pittsburgh, Pa. Patent 1,885,095.

Processes

Method of Welding. Charles L. Wiles, Detroit, Mich., assigned to Budd Wheel Co. Patent 1,884,455.

• TRADE PUBLICATIONS •

BOLTS, NUTS AND SCREWS. Clark Bros. Bolt Co., Milldale, Conn., has issued a catalog or handbook on bolts, nuts and screws, the data covering heads, threads, weights, with several pages of illustrations showing special and odd-shaped bolts.

BRONZE WELDING ROD. The Linde Air Products Co., Technical Publicity Dept., 205 E. 42nd St., New York, N. Y., is distributing a booklet entitled "Oxweld No. 25 M. Bronze Patented Welding Rod" containing 20 pages, 3½x6, describing the physical and welding characteristics of this rod and many important applications. Of special note are recommendations on a new technique for bronze-welding and for the fusion welding of brasses and bronzes.

COG-BELT DRIVES. The Dayton Rubber Mfg. Co., Dayton, Ohio, is distributing Catalog No. 105 Condensed on its cog-belt drives, which is compact but complete. Prices and dimensions are included.

PACKINGS. Catalog B-1932 has been issued by The Garlock Packing Co., Palmyra, N. Y. This thoroughly illustrated book describes those styles and types for which there is general usage and demand. It gives information on the selection of packings and also several tables of general recommendations.

SAW AND KNIFE FITTING MACHINERY. A price list applying to Catalog No. 50-A has been made effective Oct. 15 by Samuel C. Rogers & Co., 191 Dutton Ave., Buffalo, N. Y. The price list covers its line of knife and saw grinding machinery.

SQUARING SHEARS. Niagara Machine & Tool Works, Buffalo, N. Y., has available Bulletin No. 72-D on power squaring shears with capacities for ¼-in. soft steel and lighter.

TOOL ENGINEERING. Machine Shop Engineering, 1503 Shadford Rd., Ann Arbor, Mich., has published the first volume of a series of small books dealing with machine shop processes. It is intended for foremen, draftsmen, tool-and-die makers and machinists. Such subjects are covered as "The Engineer in Modern Production"; "The Design, Fabrication and Use of Milling Cutters, Twist Drills and Broaches"; "Milling and Drilling Processes"; and "Modern Large Scale Forgings." Copies may be secured for $0.75 a single copy or $1 for two copies.

VARIABLE-SPEED MOTOR PULLEYS. Reeves Pulley Co., Columbus, Ind., has issued Catalog V-200 on its "Vari-Speed" motor pulley. It describes completely the design, operation and uses of this variable-speed control unit for light horsepower requirements. Complete engineering data, photographs of typical applications and a convenient information form are other features.